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UNIVERSITY OF CHICAGO CONTRIBUTIONS TO PHILOSOPHY

No. III

THE IMPERSONAL JUDGMENT

ITS NATURE, ORIGIN, AND SIGNIFICANCE

BY

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THE IMPERSONAL JUDGMENT: ITS NATURE, ORIGIN, AND SIGNIFICANCE.

The consideration of such expressions as "ὕει, χρή, pluit, mich hungert, it grows, fire," has excited much interest from the days of the Greeks. The name—impersonal or subjectless propositions—which has been given them will serve to explain this. Aristotle, the father and oracle of formal logic, asserted, upon the basis of an analysis of propositions, that every judgment must have a subject and a predicate. After his day attention was directed to the impersonal because it did not appear to conform to the rule of judgments. Thus arose a controversy which has come down to us.

This state of affairs suggests several thoughts: (A) When theories presuppose and destroy one another there is a necessity of looking for some presupposition underlying and determining the various points of view. (B) An historical review of the field of controversy is also called for. By means of it we shall obtain the various types of theory which have been held, together with their relations to one another and to the presupposition. (C) The way will then be left open for an intelligent and thorough criticism of former investigations and a method for a new investigation provided. These thoughts indicate the natural divisions into which our subject falls.

A. PRESENTATION OF THE PRESUPPOSITION UNDERLYING PREVIOUS INVESTIGATIONS.

The presupposition common to all views, with the exception of one or two, may be stated in a few words. Investigators have accepted without question the statement that impersonal expressions are judgments. And again they have admitted that the normal judgment must have a subject and a predicate. The result has been that the more systematic and logical minds have been forced to seek a subject which has eluded them at every turn. On the other hand, those who have had facts more in mind than theories have pointed out that the various subjects brought forward have been formal and empty, or have been gained through twisting the form and meaning of the proposition. It is, therefore, not to be wondered at that controversy has brought the problem no nearer to solution.

But we shall be asked on what basis the above thorough-going assertion has been made. Proof of our assertion must, therefore, be brought forward. Several reasons may be given:

I. Following the historical development several conclusive proofs with reference to antiquity present themselves:

1. Aristotle gave to formal logic that systematic form which it has retained almost without change to the present day.[1] In the hands of the rhetoricians it was made the instrument of argumentation, and was regularly taught in the schools established in the towns and cities.[2] By the time of the Middle Ages, formal logic had become the universal method of investigation, and by its use the doctrines received on the authority of the church were elaborated and defended.[3] Although beginnings of inductive research are noticeable early in Greek thought, it was not until the dawn of the modern era that they were set on an independent footing. Toward a formulation of inductive inquiry the two Bacons did much, but it remained for our own century and Stuart Mill to make, in England, a systematic presentation of the method. And even yet science is not fully conscious of its own inner method of procedure. These facts, which are now commonplaces in the philosophic world, make it evident that all ancient criticism proceeded (and necessarily so) upon the basis of formal logic. This thought becomes more forceful when we remember how the spirit of speculation in and of itself died out after Aristotle. Thought turned more and more to ethical and religious questions. Logic busied itself mainly with matters of detail, until in the skeptic movement it seemed to be devoid of all content whatever. In the succeeding period authority supplied the content, but formal logic gave the method for the manipulation of this content both in the religious and secular schools.

Now formal logic has always insisted that every judgment or proposition must have both a subject and a predicate. Aristotle first made this assertion upon the basis of an analysis of the Greek sentence. The assertion next took the form that predication necessarily involved something of which it was predicated, *i. e.*, a subject. Further, there was no doubt that impersonals (with the exception of such expressions as χρή, which proved too refractory to the methods of reduction then

[1] See Prantl, Geschichte der Logik im Abendlande.

[2] Hatch, Hibbert Lectures, 1888, pp. 25 ff.

[3] See histories of philosophy in general; also Prantl, Gesch. der Logik.

known) were genuine judgments. Hence the search for a subject was a matter of pure consistency.

On the other hand, those who most strenuously opposed the logicians never brought the general doctrine of the judgment into question, but simply asserted that the logicians were perverting language in their attempts to find a subject.[1]

2. The fact which directly proves our assertion is, that in both ancient and modern times (with few exceptions) the impersonal has been regarded as an anomaly.[2] It indeed seemed to be a freak of thought, and all endeavor was turned toward explaining its peculiar nature. This fact is so evident that no detailed proof is necessary. From the time of Quintilian until the present day the impersonal has remained something strange and uncouth. The long-sustained controversy stands as testimony to the fact that this form of expression is sufficiently individual to baffle the most earnest endeavors to bring it consistently under the general form of mental assertion.

Putting the two proofs together there can be no doubt that a presupposition, such as we have described, underlay all investigation of the impersonal judgment in ancient times.

II. When we come to modern times the nature of the presupposition becomes very evident. It is true that of recent years logic has begun to be reconstructed more upon a psychological basis, but much of ancient tradition still remains, and this shows itself particularly in regard to the judgment. Most logicians assert with confidence that all judgment must be twofold, must have a subject and a predicate, while the few who stand for a new interpretation are regarded as quite erroneous.[2] With regard to the treatment of impersonals the recognition of the presupposition determining investigation is quite complete. Erdmann says,[3] "In all of them (impersonal judgments) a cause, be it ever so undetermined, is presented . . . . since an event without a substrat, a quality without a subject, is altogether unpresentable." Kaindl,[4] although endeavoring to solve the problem on traditional lines, recognizes very clearly the basis on which most of the investigations have been made. His words are worth quoting: "The

[1] For details see below, pp. 8 ff.

[2] For details see below, pp. 8 ff.

[3] Logik, p. 304.

[4] Wesen und Bedeutung der Impersonalien, p. 278. *Cf.* Schuppe, *Zeitschr. für V., Psy. u. Sprachwiss.*, Bd. 16, pp. 244 ff.; Venn, Empirical Logic, p. 233; Steinthal, *Zeitschr. für V. Psy. u. Sprachwiss.*, Bd. 4, pp. 235–7.

question as to the essence and meaning of impersonals is old. The ground of interest lies near enough. While, according to grammar, each proposition must have a subject and a predicate, and, according to logic, of a subject, a predicate notion is affirmed or denied, in the expressions, 'Es donnert,' 'Es ist mir wohl,' 'Es ist Tag,' the subject seems to be lacking. Now, since from the grammatical standpoint it could not be denied that 'Es donnert,' etc., were propositions, from the logical point of view they had to be considered as judgments. Thus there arose a contradiction which gave rise to many attempts at explanation." Kaindl spoke truly when he remarked that contradiction seemed to be the only outcome of previous investigation. This makes it all the more evident that a criticism of the underlying presupposition is necessary to further investigation of the impersonal.

B. HISTORICAL RESUMÉ.

The various theories of the impersonal may be classed under two general heads: (I), doctrines which emphasize the place where the subject is to be sought; (II), doctrines which are characterized by the kind of subject which must be sought.

I. The first general division falls into several minor parts:

1. The subject is sought in the grammatical form. This view is peculiarly characteristic of ancient thought, and the reason is not far to seek. The clear-cut distinctions which moderns make between the subjective and the objective, between thought and expression, or, again, between judgment and proposition, are a late acquisition.[1] At first the mind recognizes no distinction between them and interprets both from the objective side. Thus Aristotle derived his doctrine of the judgment from the analysis of propositions. The logicians who followed him were rhetoricians as well as logicians, and for a great length of time logic and rhetoric were inseparable. Hence the early form of the controversy under consideration was concerned with the possibility of finding a subject in the structure of the proposition. Three types of this view appear: (*a*) the Greek, (*b*) the Latin, (*c*) the Italian.

(*a*) The Greek grammarians thought that a nominative should be supplied, and for this purpose "Zeus" seems to have been the favorite —Zeus rained, thundered, snowed. This points to a comparatively advanced stage in thought, a stage in which particular gods (and finally one god) were supposed to be the causes of natural changes in general,

[1] See Burnett, Early Greek Philosophy, Introduction.

and especially of those not referable to some known, finite cause. These verbs were denominated *θεῖα ῥήματα*,[1] on account of their reference to the deity as the cause of the events they indicated. A number of exceptions (*e. g.*, Δεῖ, *χρή*) were found to this rule. In these Zeus could not very well be taken as the subject. To obviate the difficulty such verbs were straightway interpreted as adverbs, and the Greek logical conscience seems to have been satisfied.

(*b*) In the main the Roman investigators expounded and defended the position of the Greek grammarians; in all things literary the latter were always the inspiration of the former. About the only contribution made by the Romans was in seeking the subject in the infinitive. Quintilian,[2] who set Roman rhetoric upon a firm basis, remarked upon the difference between the personal and the impersonal forms. He perceived a difference between "panditur interea domus omnipotentis Olympi" and "totis usque adeo turbatur agris." In the latter a starting point, an "initium," is lacking. According to Priscian,[3] he who wishes to understand the impersonal must seek a subject in the nominative of the activity implied in the verb. For example, when we say "curritur" we mean "cursus curritur," also "eventus evenit," etc. That is, Priscian accepts the position, but finds the subject otherwise than in Zeus.

The opponents of those who sought a subject in the grammatical structure of the proposition contented themselves with pointing out that a real subject was lacking, and that every attempt made to supply such a subject had vitiated the original meaning. Here we may cite Maximus Planudes and Augustinus Saturnius. Planudes[4] said, "There are certain verbs that in no respect signify a subject or a person (which indeed we are also want to call impersonals), having the appearance or form of the third person, but belonging to none." Saturnius,[5] in combating Priscian, gave the key to the ordinary objection in ancient days: "The gods destroy you, Priscian, with this doctrine of yours. In the first place you annihilate all impersonals with passive terminations; for those verbs to which one supplies such a nominative (*i. e.*, nominative of the activity implied) are manifestly of this sort. Then, afterward you attribute to all of them a passive meaning. But in truth this, your principle, if it be true, must also be understood

[1] Apollonius (Egger), p. 174.
[2] Miklosich, Subjectlose Sätze, p. 7.
[3] Priscian, 2 : 230, 2 : 231.
[4] Bachmann's Anecdota Græca, 2 : 47.
[5] Sanctii Minerva, p. 305.

throughout the whole conjugation of the verb. And so, whatever nominative is understood (or the nominative of a verb in the passive tense), this of course must be understood throughout all the remaining forms of its declension. Wherefore, when Tacitus says 'procursum est ab hoste,' here I beg you, Priscian, can that nominative of yours be rightly understood for verbs of the perfect tense?"

(*c*) In the Italian school we have the connecting link between the ancient and modern schools. Rinaldo Corso approached the subject principally from the objective, grammatical standpoint, but there was in him also a tendency to view the matter subjectively. A short quotation will give his view succinctly:[1] "That verb is impersonal with which there does not belong some person first, second, or third, but which, by means of the semblance of the third person, indicates some phenomenon in a general manner."

All these theories show clearly that great difficulty was experienced by ancient and mediæval logicians and grammarians in explaining impersonals. So long as they thought simply of the grammatical structure, the most natural interpretation was that the impersonal was really subjectless. As logicians, however, they were forced to search for a subject, and this led to constructions of propositions which to the ordinary, non-logical eye were fantastic and impossible. The tendency to pass from the proposition to the judgment, from the outer world to the inner, was necessitated by these contradictions, and was in direct agreement with the movement in the whole world of thought at the time. The first clear application of this to the impersonal was made by the Germans.

2. Having searched in vain for a subject in the grammatical expression, investigators began to turn their attention to the psychological structure. There was reason for this movement. As we have seen, thought had at first an objective outlook. But gradually the inner life differentiated itself from the outer expression, and a study of it for itself began to be made. This movement first made itself felt[2] in later Greek life and philosophy, but it was not until the Christian era that personality and the inner world came clearly to consciousness. Throughout the Christian ages the human soul was the great center of interest. However, it was not the structure of the soul in and of itself which was interesting. To the church

[1] In Venetia, 1562, 8, parte quarta, p. 365.

[2] See Windelband, and histories of philosophy generally.

it was an object of salvation. Hence, although Augustine made a close analysis of the inner life, this analysis proceeded upon the basis of the development of the soul through Divine Grace. The same may be said of the mystic movement. It was not until the time of the Nominalists and John of Salisbury that psychology became interesting in and of itself. Then, indeed, the mind which had served a long apprenticeship in the formulation, defense, and finally in the attack of the dogma of the schools, became aware in some measure that it had worth itself. When once the inner world came to be treated on a secular and scientific basis, the world of thought changed entirely. Theories of knowledge instead of theories of being, induction as opposed to deduction, science and psychology, began to force themselves to the front. In due time attention was turned from the formal expression of thought in the proposition to its warm, living nature in the judgment.

As regards the impersonal, the development of comparative philology not only aided but compelled the search for a subject in the processes of thought. At first there was some wavering and uncertainty, but in the end philologists were forced to admit that the subject as ordinarily sought did not exist at all.

Among modern philosophers Herbart[1] was one of the first to call attention to impersonal expressions and to recognize the lack of a subject. Vater,[2] the philologist, admitted that the subject is completely unknown. Sacy,[3] being unable for logical reasons to conceive a predicate which had no subject, endeavored to meet the difficulty by supposing an ellipse. Miklosich, who did the first thorough-going work upon the impersonal, and who is an authority upon the linguistic side, criticized most destructively the objective value of the impersonal "It." He said:[4] "The division of propositions into subject and predicate is not founded in speech, for there are judgments in which the subject is lacking. In the proposition 'Pluit' the subject is not only unexpressed, but it is not thought. In all such judgments an event is expressed without the operating subject being named. It is thus altogether incorrect when it is maintained that the subject of such a judgment is undetermined. Further, it is incorrect, also, when the

[1] Lehrbuch zur Einleitung in die Philosophie, pp. 104–6.

[2] Lehrbuch der allgemeinen Grammatik, Halle (1805), p. 120.

[3] Grammaire Arabe, 2d ed., 1831.

[4] Subjectlose Sätze, pp. 2 ff.

ground of the peculiarity of such judgments is sought in the verb, and the verbs are divided into personal and impersonal. Finally, it is a mistake when the subject is sought in the pronoun 'Es,' which in several languages accompanies the so-called impersonals. In 'Es' no living subject lies. There is only the appearance or picture of it. When the subject is more determined we may say 'Zeus pluit,' but this is not given in the 'Es.' The impersonal 'Es' in German has no equivalent in the greater number of languages. . . . The subject is a contentless form word. . . . When the close connection between the subjectless proposition and the neuter gender is considered, one is led to the thought that those languages in which the neuter is lacking, because they know no difference in gender, should have no subjectless propositions at all. However, the Semitic and Romance languages contradict this. . . . Again, what are we to say when we perceive this usage in the Magyar, in which the difference of gender is unknown?"

Now, not only is this position maintained by those philologists who say that no subject can be found in the grammatical structure, but the contention is admitted by those who still maintain the traditional view of the judgment. To prove this point a quotation from Paul is all that is necessary:[1]

"Our assertion that two members, at least, go to make up a sentence seems to be contradicted by the fact that we find sentences consisting of only a single word or of a group forming a unity. The contradiction is explained by the fact that in this case one member of the sentence is taken for granted, and finds no expression in language.

"In order to answer the question concerning the impersonal judgment properly, a strict division must be made between the grammatical form and the logical relation denoted thereby. If we regard the first merely, it cannot be doubted that sentences like 'Es rauscht,' 'Il gèle,' low Servian 'Vono se blyska' (it lightens), have a subject. But all efforts have proven fruitless to treat this 'Es,' 'Il,' 'Vono,' as a logical subject and to give it a definite interpretation. Again, in sentences like the Latin 'Pluit,' Greek 'ὗει,' Sanscrit 'Varsati,' Lithuanian 'Sninga,' we may assume that the formal subject is not wanting. For such subject may be contained in the verbal termination under which a personal he, she, or it may be understood. It certainly may be said for the opposite view that in the languages in question the third person can stand also by the side of an unexpressed

[1] Principles of Language, pp. 116 ff.

subject (Jupiter pluit, ὁ Ζευς ὑει). But it is impossible to prove that the impersonal did not arise before this form of applying it. It seems most natural in this case to recognize a formal subject. It is with the personal ending just as it is with the dependent pronoun. The sentence as it is brought into the normal form has received a formal subject, which has nothing to do with the psychological. We must presuppose an older stage in which the simple verbal stem was set down — a stage which is actually seen in the Hungarian at the present day, where the third person singular has no suffix. And we can form a lively idea of this stage of language after the analogy of the sentences just discussed, which consist of a single (not verbal) word. These are really and truly, so far as linguistic expression goes, subjectless."

Thus both sides seem to be agreed that the endeavor to find a real subject in the grammatical structure must be abandoned altogether. Some investigators (as for example Miklosich and Marty), have been led by this to the view that the doctrine of the judgment must be reconstructed. The necessity for this view will be elaborated later. The majority of investigators, however, have turned to the psychological side to seek a subject. This type of theory maintains that in the impersonal form language is an inadequate representative of the real thought, and that a subject in some form must be sought in the thought process. This has given rise to a great variety of theories, and any discussion must depend upon a classification of views based upon the kind of subject sought. This, however, leads us to our second great division in the historical review.

II. As stated above, a great variety of theories here present themselves. In classifying these I have proceeded mainly on the lines laid down by Marty.[1] In this classification two great types (with many subdivisions to be noted later) appear :

1. The subject is universal or undetermined.

2. It is individual and more or less determined.

1. In the view of investigators of this type the subject to which the quality, activity, or event is referred is a vague, shadowy beyond. This may be the "Totality of experience," the "All comprehending Reality," the "Something or another, we know not what," or other subject in varying degrees of indefiniteness. These forms may be:

(*a*) Indicated in the verbal stem. These have been treated above

[1] *Vierteljahrschrift für wissenschaftliche Philosophie*, Bd. 8, pp. 56 ff.

under the classification of views according to grammatical structure. Priscian was the main representative of this view, but with him must also be classed Theoktist, Sanctius, and Vossius.

(*b*) Indicated in some other way.

a) The subject is something or another, we know not what. The defenders of this view admit that the grammatical subject is purely formal, but maintain that it is unthinkable that there should be predication without any subject of which the predication is made. This subject, however, is altogether undetermined and unknown. Every attempt to determine it has but revealed our ignorance of the true cause. Thus all grades of determination must be ruled out. Upon the basis of a mental necessity we recognize the presence of a subject which conditions the present appearance, but which itself is completely unknown and undetermined. Two eminent representatives of this point of view are Wundt and Erdmann. The former, speaking of impersonal expressions says :[1] "Judgments of the kind, 'It lightens,' 'It rains,' have been regarded as subjectless judgments. The name is evidently incorrect, for to that judgment the subject is by no means wanting, but is only left undetermined. The ignorance of the subject to which a predicate is attached is in general the ground of the undetermined judgment." The latter treats the impersonal as indicative of an undetermined cause :[2] "We must first cast out all judgments in which there is a reference to a determined logical subject. There remain as pure representatives the propositions referring to meteorological phenomena, *e. g.*, 'Es regnet,' 'Es blitzt.' . . . . In them the subject is presented as undetermined. . . . . In all such propositions a cause, be it ever so undetermined, is presented . . . . since an event without a substrat, a quality without a subject, is altogether unpresentable."

β) It has been said that Wundt and those of the same opinion treat all attempts to determine the subject as illusory. But inasmuch as such attempts have been made they must be noted. Moreover, these attempts are manifest in the impersonal judgment itself. Erdmann plainly intimates that we must regard as impersonals, only those which refer to meteorological phenomena and are causal in their significance. This, however, is an arbitrary procedure.

[1] Logik, I, p. 155. *Cf.* M. Jovanovich, Die Impersonalien, p. 45.

[2] Logik, p. 304. *Cf.* Fr Kern, Die deutsche Satzlehre, 2. Kap.; Steinthal *Zeitschr. für V. Psy. u. Sprachwiss.*, Bd. 4, p. 235; Grammatik, Logik und Psychologie, pp. 92 ff.

The types of theory which fall under this head show many grades of determination. The subject may be simply the "Totality of experience," or the "All-comprehending Reality." But this experience, or reality, takes now one form and now another. The general characteristic of all the views is that the subject is vague and general, but the vagueness and generality are not always of the same degree. Here we may quote Ueberweg[1] as especially representative of this kind: "The subject can never be entirely lacking to a judgment and proposition. But, indeed, the determined subject presentation may fail, and the bare 'Something' takes its place. In 'Es (oder Etwas) ist ein Gott,' 'Es giebt ein Gott,' the undetermined presented Totality of Being, or an undetermined part of the same, becomes the subject, as in the propositions 'Es regnet' 'Es schneit.'"

2. In this second division the subject of the impersonal appears as individual and determined. Here we have several views. On the one hand we have the view represented by Bradley and Bosanquet, on the other the view of Sigwart.

Bradley and Bosanquet waver between regarding the subject as a vague beyond, to which reference is made, and the mere sense impression. To them the subject is individual in the sense of pertaining to sense experience, but nevertheless it transcends the sense impression. They thus form the connecting link between those to whom the subject is undetermined and general and those who conceive it as something so particular and determined as the mere sense impression. Bradley says:[2] "In 'Wolf' or 'Rain' the subject is the unspecified present environment, and that is qualified by the attribution of the ideal content 'Wolf' or 'Rain.' It is the *external* present that is here the subject. But in some moment of both outward squalor and inward wretchedness, where we turn to one another with the one word 'miserable,' the subject is here the whole given reality."

Sigwart is more definite in his view. For him the subject must not be confused with any internal object. It is found in the sense impression. That is, in the judgment, so-called, a sense impression of varying content is recognized by means of a familiar idea. But we shall let

[1] System der Logik, 3. Aufl., pp. 162 ff. *Cf.* Lotze, Logic, Vol. 1, §§ 47–9; Prantl, Reform-Gedanken zur Logik, Phil.-Hist. Cl. Akad. zu München, p. 187; Schleiermacher, Dialektik, § 304.

[2] Logic, p. 56. *Cf.* Bosanquet, Logic, Vol. I, p. 109; also Essentials of Logic, p. 61 *a*.

him speak for himself:[1] "Real impersonals are those in which the thought of the thing to the predicate would apply is entirely wanting, in which we cannot even ask what the thing is. When we say in German 'mich hungert,' 'mich dürstet,' there is no room for the question, 'Was hungert mich?' any more than a substantive can be a subject to 'pudet' or 'poenitet.' When real impersonal propositions serve to express something which is accessiblc to immediate outer perception,—'Es donnert,' 'Es blitzt,'—then we start from a simple sense impression, to which neither perception itself nor memory supplies a subject. When, for instance, I see a rocket rise or hear a carriage rattle over the pavement, the action immediately added to the sound or sight which was given alone is naming—the unification of the present impression with a familiar idea. . . . The reference to a subject which is contained in the pronoun of modern languages is then an empty, customary form. These judgments, however, are without a subject only in the narrower sense that a subject thing is wanting. They are no exception to the general nature of the proposition which expresses a judgment. They contain the synthesis of a known general idea with a present phenomenon, and it is this phenomenon which is the subject and which is indicated by the personal ending with its original demonstrative significance."

Turning from these types of theory we come upon another form, essentially different:

3. From earliest times there has been opposition to the view that a subject could be found for the impersonal judgment. We have seen that when the search was confined to language, there was a feeling that a subject could be made out only by twisting the meaning of the proposition. The early critics showed pretty clearly that too many absurdities would be involved in the attempt to reduce the impersonal to the normal type. However, when comparative philology arose, the battle was finally decided in favor of those who maintained that the impersonal was subjectless. Our quotations from authorities on philological questions who represent opposite views on the logical problem have shown that the grammatical subject is empty and valueless.

Then came the position of those who sought a subject in the

[1] Logic, Vol. I, p. 62. *Cf.* Impersonalien; T. Ziegler, *Phil. Monatshefte*, Bd. —, pp. 42–7; Schuppe, *Zeitschr. für V. Psy. u. Sprachwiss.*, Bd. 2, pp. 244–97; R. F. Kaindl, Wesen u. Bedeutung der Impersonalien, *Phil. Monat.*, Bd. 28, pp. 278–305; J. Venn, *Mind*, Vol. XIII, p. 413; Empirical Logic, p. 233.

psychical processes. The historical review has shown that the theories appearing from this point of view may be reduced to two great types. In one the subject is universal and undetermined; in the other it is individual and determined. Under these two great types may be subsumed views representing every grade of determination; so that we have a series running from the clearly determined and particular impression up to the universal and indeterminate "Totality of Being," the "All-comprehending Reality," or the completely unknown condition of the event.

These views would seem to exhaust the possibilities as regards the impersonal on the basis of the ordinary presupposition. For if a subject is to be sought, it must be found either in the outward linguistic expression or in the inner thought. If language fails, then our only resource is thought. But if it be sought in thought, the subject must either be particular and completely determined, universal and undetermined, or it must lie somewhere between these two limits.

Now we have seen that the search for a subject of whatever kind has resulted in nothing lasting. After all the criticism of the ages the problem seems to be as vexed as ever. This has been the reason why a new investigation on somewhat different lines seemed to be in order. The point of view represented by our criticism is that first indicated by Miklosich.[1] It is to the exposition of his theory that the present section is directed.

It seemed clear to him that every subject which had been brought forward was untrue, and yet it was equally clear that the admission that all judgment is twofold drove logically to a quest for a subject. He escaped the dilemma by attacking the presupposition which lay at the basis of all previous investigation. His criticism, however, simply indicated that the ordinary view of the judgment must be remodeled. The full justification of this criticism remains as something yet to be accomplished.

If we admit that the results of previous investigations have been sufficiently paradoxical to warrant a new investigation, several courses may be pursued: (*a*) We may refuse to admit that impersonal expressions are judgments, and maintain that search for either subject or predicate is futile. (*b*) We may deny that predication necessarily involves something of which predication is made. (*c*) We may ques-

[1] *Op. cit.* *Cf.* Marty, *Vierteljahrschrift für wissenschaft. Phil.*, Bd. 8, pp. 56 ff.; Bd. 18, pp. 320 ff.; Bd. 19, pp. 19 ff.

tion the validity of the presupposition and pass to a direct analysis of the experiences denominated impersonal.

The first assertion could be made only on the basis of a psychological analysis of the impersonal, and this has still to be made.

We must, therefore, turn to the second point. Can we say that the impersonal judgment presents us with a predicate for which no subject need be sought? Is predication the fundamental form of judgment? Trendelenburg[1] was of this opinion. However, this cannot be held consistently, for predication which is predication of *nothing* is a contradiction in terms. To predicate is to refer a quality; to refer a quality is to refer it to something. The statement that every predicate implies a subject is simply to say that predication is made. The judgment is analytical, and simply asserts an identity. The same may be said of quality and thing, of event and cause. Unless a quality is the quality of something, it is no quality at all. An event which has not been produced is self-contradictory. In all these cases the statement of the nature of the activity involved in the processes includes a reference to a correlate which cannot be separated from them. Erdmann[2] was correct when he said that a "quality without a substrat, an event without a cause, a predicate without a subject, was altogether unthinkable."

Thus, if we admit that the impersonal is a judgment and that all judgment is discursive or twofold, we must seek a subject, no matter how difficult the task may be.

This brings us to our third point. It still remains to us to question the assertion that all judgment is discursive. It may be that the full nature of judgment cannot be expressed in the discursive form.

The opinion that all judgment is twofold is very ancient. It goes back to the time of Aristotle and has behind it the authority of that great name, together with all the authority with which logical tradition and usage since then have invested it. To question such a generalization would seem to be exceedingly presumptuous. However, generalizations of whatever kind have their justification and sacredness only in the function which they serve. They are hypotheses or points of view, by means of which we organize different groups of experience. So long as they enable us to control experience they maintain themselves. But so soon as they fail in their function they must be set aside.

[1] Logische Untersuchungen, II, pp. 205–15.

[2] *Loc. cit.*, p. 19.

This may occur in two ways. It may be found that our first hypothesis was incorrect, and we, in that case, replace it by some other, or the hypothesis may explain a certain group of facts, but be found inadequate to others of the same order. In such a case the old hypothesis is subsumed under a fuller generalization. This would seem to be the case with the ordinary theory of the judgment. There can be no doubt, both that the discursive form of judgment organizes many of the facts of judgment, and that there are certain forms of judgment in which the theory has signally failed. It may turn out that the impersonal is no judgment at all. But however this may be, for purposes of investigation, we must, for the time being, set aside our view of the discursive as universal and examine the types for themselves. To do otherwise and to insist, as has been done, that all judgment must be discursive is to be utterly unscientific.

We have thus cleared the way for a new investigation of the impersonal; we must now endeavor to understand the impersonal on its own basis without reference to the criterion of the discursive judgment.

Before proceeding with our analysis, it is necessary to present types, not of the various theories of the impersonal, but types of the impersonal itself.

There has been a good deal of controversy whether certain expressions are really impersonal. The fullest and most careful collection which has been made so far is that of Miklosich; for this reason I have made liberal use of his material, but shall feel free to interpret it as facts may require.

Miklosich divides impersonal judgments into four kinds: (I), subjectless propositions with an active; (II), subjectless propositions with a reflexive verb; (III), subjectless propositions with a passive verb; (IV), subjectless propositions with a noun and a verb to be.

I. Under the general head of impersonals with active verbs may be distinguished:

1. Judgments which express the existence of an object; *e. g.*: "Es giebt einen Gott; Es ist ein Gott; Es war einmal ein König; Es hat grosse Bäume; Es hat an dem Orte schöne Pferde; Il y a deux ans que mon père est mort; Es hat keinen geringen Schrecken gesetzt; Es setzt wunderliche Reden ab; Es giebt etwas."

If we take expressions of the type of the first two, we see at once that they may mean one of two things. Either "Es giebt einen Gott" and "Es ist ein Gott" mean "Gott ist," or the expressions must be

taken absolutely and to express simply the recognition of that existence which has been termed God. As ordinarily used, there can be no doubt that the first interpretation is correct. In such a case the subject "Es" is purely formal, the true expression being "Gott ist." Here, then, we have to do with a disguised personal proposition.

But there is a sense in which the expression may be used absolutely. It may point to the experience which we might call "God intoxicated," in which the individual mind is so filled with the thought of God and feels it so deeply emotionally that there is no reference to existence, no discursive statement, but simply the inner, living recognition of experience itself, in the full, swelling expression "God." I suppose that in the prophetic state the feeling of unity with the Infinite (whether the experience be true or not) has been so intimate that the experience of the individual was at the same time (and immediately) the presence and life of God. In such experiences assertions are most certainly made, but they are assertions in which the parts are taken up into a life immediately felt and lived.

Of "Es war einmal ein König" the proper rendering most evidently is "ein König war einmal." The impersonal "Es" disappears altogether, showing that it was purely formal. Of "Es hat grosse Bäume" there may be two interpretations. We may suppose that the expression means that in some definite place (indicated perhaps by the pointing of the finger) great trees grow. In that case the "Es" is formal once more, for it serves merely as a symbol to indicate a subject known and definite, but which need not be further indicated, inasmuch as the center of interest is the great trees. This serves to indicate another interpretation. If our interest centers round the trees, the expression most properly becomes "great trees!" Here the exclamation points solely to the recognition of that experience which we call "great trees." The light, as it were, bursts upon us, and as the phenomena come into view, the expression of immediate recognition is forced from us.

"Es hat an dem Orte schöne Pferde; Il y a deux ans que mon père est mort; Es hat keinen geringen Schrecken gesetzt; Es hat setzt wunderliche Reden ab," may be converted simply. Again the impersonal disappears, giving way to the perfectly definite subject.

"Es giebt Etwas" may be interpreted either as "Etwas giebt" or simply as "Etwas." If we follow the interpretation "Etwas giebt," the proposition becomes existential in nature, and the assertion is made

that something vague, indefinite, general, exists. But this interpretation seems to me somewhat forced, and fails to catch the shade of meaning which "Es giebt Etwas" endeavors to convey. The meaning is more exactly rendered by "Etwas" alone. The quick, half-startled exclamation denotes the recognition in an immediate way of some disturbing occurrence or object.

A review of these types of impersonals makes it clear that (*a*) the impersonal subject is purely formal, the true subject being brought out by simple conversion; (*b*) the "Es" has more than a symbolic value and indicates a vague, shadowy subject, of which some assertion is made. It indicates, as it were, the first beginnings of differentiation within a recognized content, the bare appearance of the discursive form. (*c*) In most cases the expression is more truly turned in the form "Gott," "Ein König," "Etwas." These indicate the immediate recognition or assertion of an experience, object, or event, in which no definite subject or predicate is discursively asserted.

2. The impersonal propositions which implicate phenomena of nature have been found to be, perhaps, the most interesting of all. But when we seek to analyze the experiences simply for themselves, they become very simple indeed. The remarks which have been made concerning the first class apply here very evidently.

If we take the expressions, "Es weht," "Es weht einen ungestümen Wind," the interpretation may be twofold. The "Es" may be purely symbolic and may conceal a subject perfectly well known. That this is so may be seen by converting the second sentence. It becomes "Ein ungestümer Wind weht." It is evident that we have had in mind all along the expression "Wind" as subject. But, again, "Es weht" may be and is more properly rendered by the expression "Weht." So also with "Es blitzt, donnert, friert," etc. Or again we may use the participle "Wehend," or "Blitzend." Sigwart himself[1] asserts that the impersonal expression may be turned as truly by the participles as by the ordinary form.

The English equivalents, "It rains," "It snows," "It thunders," present the same experience. We most truly express what we mean in these cases when we simply ejaculate "raining," "rain," "thundering," "lightning." For example, after being indoors for the greater part of the day, without noticing the weather, how often in stepping outside we suddenly exclaim "rain," "snow," "lightning," as the state of things

[1] *Loc. cit.*, p. 19.

presents itself to us. The one thing in our minds has been the simple recognition of the rain, the thunder, or the lightning. Or, again, when the fire-bell rings, often the only thing in our consciousness is the immediate, clear recognition of the situation expressed by the exclamation "Fire!"

To conclude, these expressions in their essential nature present us with the immediate recognition of a situation or an experience on its intellectual or on its active side. The simple content or activity recognized immediately and standing for itself fills our consciousness for the time being. It is present in the mind as an experience taken as a totality and recognized in and through itself.

(3) In previous examples the illustrations presented us with experiences recognized on their intellectual or on their active sides. The expressions implicating states of the soul or body give us illustrations of experiences recognized on the side of feeling. Such expressions are "Mich dürstet, hungert, schläfert." These may be rendered "Ich bin dürstig, hungrig, schläfrig," so that the subject becomes "Ich," and the impersonal form disappears altogether. This is, of course, a possible and very common interpretation. But very frequently the feeling of thirst, hunger, sleep, is so prominent that it is the only thing in the mind at the time. In such cases the experience is most properly expressed in the terms "hungrig," "schläfrig," "dürstig." Here the mind is filled with an experience recognized in and through itself, and in which the state of feeling clearly predominates.

In such cases as these the utter lack of a subject in any form answering to the question "Was hungert mich?" etc., is apparent. As Sigwart says, "The moment we ask such a question it seems utterly absurd and inappropriate."

(4) When we turn to the judgments which express modifications of the senses, the truth of our assertion that the greater number of impersonals express an experience recognized immediately and as a totality is evident. In such expressions as "Es murmelt," "Es saust," there can be no doubt that the sense experience itself is most prominent in the mind. That the "Es" is purely formal and contentless may be easily seen, if we remember our state of consciousness when our fingers have been burnt. Someone seeing us start suddenly inquired for the reason of the start. The expression "burned" which has so often escaped us showed that the recognition of our state of feel-

ing was, from the intellectual side, the one thing in our minds. We may illustrate, again, by another customary expression: When we find that a metal or liquid which has appeared cool is very hot, we draw back the hand. The thought that flashes into our minds is, "Hot." We do not understand any "It," or "Something or another," nor even "The iron." Our one thought is given exactly in the expression "Hot." We should compare with this the childish expression "Burnie." I have noticed children murmur this expression to themselves when their eyes fell on something which at some time had been the occasion of a severe burning. To them the sense impression was not a sense impression as the psychologist understands it, but an immediately recognized content.

(5) The judgments which express a lack or a contradiction are not really impersonals. As noted in several cases already, the impersonal "Es" is formal and conceals the real subject. "Es mangelt an Geld," and "Ich muss schauen woran es fehlt," when converted, present subjects which are quite definite. The "Es" in "Es fehlt," which at first sight might seem to be indefinite, is not really so. The legitimate inference is that the subject of conversation requires an exposition which can be easily given. For example, what we really mean is, "Geld mangelt," etc.

(6) Those judgments which express mystery admit of easy interpretation. "Es spukt" is evidently similar to our expression "Spooks" and indicates the immediate interpretation of an experience as ghostly.

In "Es wandelt um," and "Es geht irre im Haus," the case is otherwise. In both there is a distinct reference to a "Something or another, we know not what," something undefined and vague is wandering about, or something is wrong in the house. Hence these expressions are quite different from the following:

(7) "Es geht mit dieser Sache wie mit der andern." "Es geht ihm um den Kopf." In the first the subject evidently is "Diese Sache," as may be seen by converting the proposition. In the second, "Es" refers to some definite thing (*e. g.*, a band) which encircles the head.

II. We turn now to the second great class of impersonals, viz., subjectless propositions with a reflexive verb.

In such expressions as "Es setzt hier schlecht," "Des Morgens geht sich's gut," "Il fait bon marcher le matin," "Es giebt sich leicht, wenn

man reich ist," a perfectly definite subject may be gained by converting the sentences. This point comes out very clearly when the English equivalents are given. We say, "That (the affair) has been poorly arranged," "Affairs go well in the morning," "The walking is good this morning," "Living is easy when one is rich." Such impersonals belong, therefore, to the class which are impersonal only in form, and in which the formal conceals the true subject.

III. The impersonals with a passive verb may, for the most part, be disposed of by conversion. If we take the expressions "Es wird gegangen, gelacht, geliebt," "Gott sei's gedankt," "Stets gegrundet, stets geforscht und stets gegründet," by throwing them into the active form, the subject (be it the event, person, object, God) becomes at once definite and concrete.

IV. Turning to the last class of impersonals—subjectless propositions with a name and the verb to be—we find that they can be reduced with ease to the several forms already distinguished.

In such expressions as "Es ist kalt," "Es ist dunkel," the meaning may be expressed by "Der Abend, der Tag ist kalt, dunkel." In this case the subject is definite. Again, the meaning may be indicative of the recognition of the state of affairs as one steps outside. In such cases the expression should be "Kalt!" "Dunkel!"

Of the expressions "Es wird Abend, Morgen," "Es sommert, wintert," there may be several interpretations.

We may simply convert the sentence, as with the first expressions, and so gain a definite subject which, until conversion, had been concealed by the symbolic form. Or the "Es" may be taken to indicate something, we know not what, which is regarded as the cause of the phenomena; or finally the expressions may be taken absolutely, the meaning being conveyed in the immediate recognition of the event expressed by the exclamation "Abend!" "Sommert!"

Our review af the various forms of impersonals is thus complete. And unless our analysis has been incorrect, our result may be summed up in the following:

The formal subject may be interpreted in several ways:

1. It is purely formal and may be displaced by conversion.

2. The "Es," "It," or their equivalents, have more than a formal value. They indicate a vague, shadowy, undifferentiated subject.

3. In by far the greater number of cases the expressions show no discursive reference of a predicate to a subject. The true meaning

is indicated in the expression of an experience immediately recognized. This experience may represent any one of the three aspects of life, *i. e.*, it may be the recognition of an event, of a content, or of an affective experienee.

Here we may remind ourselves of certain remarks made by Wundt and Sigwart in their consideration of the impersonal. Wundt says :[1] "All impersonal propositions are not undetermined judgments, but frequently a determined presentation conceals itself behind the apparent undetermined demonstrative pronoun. We do not say, 'It is John' in the same way in which we say, 'It rains.' The former is no longer undetermined." To this we shall add Sigwart's words[2] as explanatory of the difference between the true and the apparent impersonal: "When I say, 'It is beginning,' 'There it goes,' 'It is over,' 'It is finished,' I always mean something definite, a series of events either expected or going on—a play, a piece of music, or a battle. And I assume that the person who hears me has his attention directed toward the same thing, so that any more accurate denotation is unnecessary. Here 'It' is a real pronoun, which is only chosen for the sake of brevity, because the usual denotation of what I mean is superfluous, or, perhaps owing to the nature of the thing meant, too circumstantial."

Hence this type of impersonals does not really belong to the class, and may be thrown out altogether. They are only apparently impersonal or subjectless.

This leaves us with two types for our consideration. On the one hand we have the type of judgment in which the subject is something general. As we have seen, this subject may be the mass of sense experiences, the universe in general, the all-comprehending Reality, or again something or another, we know not what. The attempt made by Jovanovich[3] to rule out this type of impersonal judgment is altogether arbitrary. He proceeds upon the basis that such judgments would be impossible to primitive men and are rare to the mind of the ordinary individual. Now it may be true that the logical formulation : "The universe in general," "The all-comprehending Reality," etc., may be very far indeed from most minds, but this is no objection applicable to the case in hand. The thought formulated in these general expressions need not be far from any man, primitive or reflect-

[1] *Loc. cit.*, p. 19; *loc. cit.*, p. 19.

[2] Die Impersonalien, pp. 21 ff.

ive. Indeed, the type of thought represented in these is vague, undifferentiated, and schematic. In them a predicate now defined for the first time is referred to a vague, shadowy whole which has been experienced and which now is just beginning to be broken up and distinguished. In fact, the reference of the experience to the all-comprehending Reality presupposes a simpler and earlier stage of thought than that represented either in the thought that the subject is a particular thing endowed with life, or cloud gods, or even such a god as Zeus. These belong to the stage in which experience has become so differentiated that particular things may be regarded as the causes of certain phenomena.

Again, the fact that so many types of theory have arisen which have in common only this that their subjects are general show that a gradual differentiation has taken place within this class of theories. This differentiation has proceeded from stage to stage, until finally the undifferentiated subject has become so definite as to take on the form of a particular thing to which reference might be made. This idea is further supported by the fact that no hard and fast line can be drawn between those impersonals to which we now add a purely formal subject and those in which the impersonal pronoun has a definite signification. This type of impersonal may be regarded as exhibiting the characteristics of the ordinary discursive judgment. And from this point of view the statement of Lotze that the impersonal has preserved to us practically the original and simplest form of the discursive judgment, seems to be correct.

Turning to the other great division of impersonals, we note that the experience centers itself in an immediately recognized whole. As distinguished from the first great division, there is no conscious reference to a subject, however indefinite. Here we must review the theory of Sigwart.

He, it will be remembered, maintains that in the true impersonal a present impression is recognized by means of an idea or memory image of a past experience. Now it cannot be denied that in the recognition of an experience an impression and a memory image are involved. Were it not so, there would be no such thing as recognition at all. But it is not necessary that the memory image and the impression be held apart and referred to one another. And this would seem to be the case with impersonals. For Sigwart the subject is found in the sense impression and the predicate in the memory image. Now

the assertion of their identity must be made consciously, if no exception to the ordinary discursive form is to be presented. But this is not the case. It is only upon reflection that we become aware that there is an impression and an idea. In the experience itself the two are so intimately associated that we are conscious only of the result of their combination, and not of the process leading to this combination. For example, let us take the case of "Fire." When the exclamation is suddenly made, we do not think of the impression, and of the memory image. What we have in mind is simply the familiar situation — an experience immediately recognized. Truly, an impression is present, and an idea by which the impression is recognized. But it is the recognition and the recognized content which interest us. No discursive reference is made. So in all the cases cited above: an experience (be it an intellectual content, an affection, or an activity) is recognized through an idea which is immediately assimilated to an impression of sense. The result of the assimilation alone appears in consciousness in an experience recognized in and through itself. In short, what we have in impersonals are cases of immediate recognition.

To proceed further. There are two forms of the impersonal. In one an experience is recognized in and through itself as a totality and in an immediate way; in the other the recognition is mediate and by means of the pasts. The former is non-discursive, while in the latter the discursive form appears. In both forms there is growth in definiteness. In the immediate form there is a passage from the merest scheme of a separable situation to a situation or experience so definite and complex that recognition can no longer be immediately made, and a predicate referred to this total experience appears.

So also with the discursive form. The subject passes from the barest indication of a subject through varying degrees of definiteness, until finally some definite and known subject takes the place of the subject impersonally indicated.

To our analysis we may now add one further argument in proof of our theory. This theory alone harmonizes the varying divergent views which have been held from earliest times.

Our historical review showed that the divergent theories could be reduced to two great types: (I), those which asserted that the subject must be individual and determined; (II), those which asserted with equal force that the subject must be universal and more or less undetermined. In the analysis given above these two fall together in the

forms of the impersonal as immediate and mediate. Where the subject is individual, it is immediately assimilated with the predicate or idea, *i. e.*, both subject and predicate really disappear; and where the discursive form really comes on the scene, the subject is undetermined and universal.

But not only does our view enable us to harmonize the views concerning the nature of the subject sought; it also shows us how we may place the presupposition which forced so many investigators to seek for a subject.

It was admitted as incontrovertible that a predicate could not be thought, apart from a subject. The two are corelative. In the discursive form of the impersonal we noted that certain qualities were abstracted and referred to a subject, whether it was completely unknown and indeterminate or only partly so. But in the immediate form of the impersonal no abstraction was made. There was no reference of parts to a whole: the qualitative experience was recognized and asserted as a totality. The meaning, instead of being gained piecemeal, was flashed into the mind at once. Now, inasmuch as the function of judgment is that of obtaining truth or meaning, there can be no doubt that the impersonal is truly a judgment. In fact, nobody has denied this. And yet, if this be so, it is impossible that the nature of the judgment can be summed up in the discursive form. As Miklosich asserted, our ideas of the judgment must be radically remodeled. The impersonal as immediate presents us with a form of judgment in which there is no subject and no predicate. The function of both is represented in an experience or situation of such a degree of definiteness as to have an individuality of its own, and in which a totality is recognized or asserted as real. The discursive judgment gives us meaning and recognizes reality, but through the mediation of the whole by its parts. Some predicate is emphasized for the time being, and is asserted as sustaining a definite relation to the subject-matter to which it referred. Judgment thus consists essentially in the recognition or appreciation of reality, whether in an immediate or in a mediate way. It is only in the mediate form in which the recognition of the whole takes place through the emphasis and development of the parts. In this connection several points must be noted:

1. It will be objected to our assertion of the originality of the impersonal judgment that in certain languages the impersonal symbol arises *after* such definite subjects as Zeus and Jupiter have been found

insufficient. It will be said that the progress of thought found such expressions unsatisfactory and unscientific, and that then the impersonal arose and was used to indicate a perfectly undetermined subject.

Now, it is true that if every impersonal arose after the determined judgment, the assertion that the impersonal form of judgment was original would most certainly be false. But several facts must be noted. The objection takes into account only those forms of judgment in which there is an impersonal formal symbol. All those forms of expression in which the judgment expresses an immediately recognized experience have been left out altogether. So that even if we were to admit that the objection held as regards those forms which possess the formal symbol, our contention would still hold good. But, again, how far this claim of the late origin of the formal "It" is true is a matter of grave dispute.[1] Finally, the difficulty arises mainly from the confusion of the impersonal symbol with the neuter pronoun. The impersonal expression may indicate many different degrees of determination, and to confine the meaning to the neuter "It" is an impossibility. The indefinite neuter may well have arisen late and have succeeded more definite and personal forms. But this has nothing to say against the originality of the true impersonal.

2. We may also be asked what relation the impersonal situation or experience bears to ordinary sensation. Both are immediate, and in James' terms might be spoken of as "acquaintance with," while the discursive form of judgment would fall under the category of "knowledge about." The chief difference (and it is an important one) is that of complexity. We commonly regard sensation as the simplest element in consciousness at which analysis can arrive. Or, again, it is the immediate result in consciousness of an affection of the organism. The impersonal judgment (in its immediate form) points to a differentiation within the "big, buzzing, blooming confusion" of early consciousness. Certain centers or kernels of experience have been formed, each of which immediately feels and recognizes its own totality. These centers have been differentiated sufficiently to be centers, but not sufficiently to give rise to a discursive division within themselves.

These remarks really conclude our analysis of the nature of impersonal judgments as we meet with them in adult consciousness. Before

[1] *Cf.* Miklosich, Subjectlose Sätze, pp. 13 ff.; Th. Benfey, *Göttingischen gelehrten Anzeigen*, 1865, pp. 1778–92; Paul, Principles of Languages, *loc. cit.*, p. 22.

proceeding to inquire into the significance of the impersonal it may be well to summarize our results so far:

I. The impersonal judgment has two forms: 1, the original, in which an experience, whether on the side of content, of affection, or of activity, is recognized as an immediate and more or less definite situation; 2, the secondary, in which this immediate experience splits up into subject and predicate, the predicate consisting of an event or experience abstracted from the total content and referred to a subject, either as unknown, as the totality of experience, or as some form of a general and undifferentiated subject.

II. In both the immediate and the discursive forms of this impersonal growth or differentiation takes place. The growth within the immediate form makes the experience so complex that it can no longer be recognized as a totality, but must attain unity through conscious analysis and synthesis — *i. e.*, through the conscious mediation of the whole, through the parts and the references of the parts in definite relations to the whole. In the discursive impersonal growth represents itself in a constant organization of the subject-matter, until finally the subject is reduced from the universe in general, the totality of being, to some definite thing, at which stage the impersonal displaces the particular judgment.

III. Our conception of the nature of judgment must be modified. The traditional view has been that all judgment is discursive, and consists solely in references. It is now evident that the discursive judgment is simply one phase of judgment. Although it may be true that there can be no predicate without a subject, it may also be true that there is a form of judgment where neither subject nor predicate appears.

This was given in the immediate impersonal judgment in which a definite experience or reality was recognized in and through a totality. The real nature of judgment would thus seem to be recognition or association, and this in two ways: (*a*) immediately, (*b*) mediately.

C. THE SIGNIFICANCE OF THE IMPERSONAL JUDGMENT.

The impersonal judgment has significance in our present investigation in two ways, and in both of these its significance is very great.

They are: (I), its significance for logic; (II), its significance for psychology.

I. THE SIGNIFICANCE OF THE IMPERSONAL FOR LOGIC

has already been dealt with to some extent. It has been seen that the traditional view of the judgment must be radically remodeled.

It has been agreed that judgment has had to do with the apprehension of meaning. But this apprehension, according to the old view, must be discursive. Reality in whatever form was recognized mediately through the reference of an idea beyond itself to some whole apprehended through it. The earlier view that in judgment two or more separate notions were united was displaced by the view that the judgment is unitary. In it a whole is grasped, but grasped through the mediation or adjustment of the parts. The parts are, as Bradley calls them, adjectives torn from the mere psychosis and used to indicate or symbolize the whole experience apprehended as meaning. In this discursive form it was imperative that every predicate should have a subject, for the very nature of the act of predication involved a subject of which predication was made. The impersonal, which was really a judgment (for in it reality was apprehended and meaning asserted), refused to conform to the general rule, for in most cases no subject could be found for it at all. Quite fictitious subjects were made for it, but on the whole it was treated as an anomaly. It never seemed to be considered that anomalies, exceptions, are often the most fruitful things for any investigation. A thorough-going consideration has shown that the impersonal truly asserts or apprehends meaning, and that its nature is not discursive. The meaning is recognized not through the reference of the parts to the whole. No symbol is abstracted and referred beyond itself. Parts and whole are apprehended in the same act and immediately. There is meaning, and we stand face to face with it. Reality truly is recognized and asserted, but not discursively, and symbolization is necessary. In the one case no abstraction of parts which are symbolic of the whole experience, is made. The experience is definite, but the thinking is concrete. In the other case abstraction from the reality is made, and a definite symbol is used, summarizing and organizing the whole body of experiences which it indicates. In this case thinking is abstract. The impersonal judgment is less definite and free when the experience asserted has meaning for itself alone, and its parts are so taken up into the total experience that, although some definiteness has been introduced, the measure according to which definition

has been made has not been clearly before the mind. It has this advantage, however, that it feels itself to be in most intimate relation to reality, is organically one with it, and, again, it is thoroughly concrete and for itself.

On the other hand, the discursive judgment which makes use of symbols is more free from individual experiences and can indicate or refer to a wider range. In the discursive judgment the idea of universality comes in. Not only is the discursive form of judgment freer than this impersonal, but it is also more definite. The symbol which is abstracted becomes a common measure of the various experiences to which it refers. And not only so, but, in becoming a measure, its own nature as a measure becomes more exact, and the relations in which it stands to the experiences which it indicates are more fully known. Finally, in the universal judgment the symbol is taken as perfectly exact, both in its own nature and in its reference; that is, the symbol has become fully abstracted and freed. We know exactly what it means, and to just what it refers. In short, we have exact measurement, through symbolization in which the nature of the measure is exactly known and can be used in perfectly identical ways, and also in which its range of reference is known, *i. e.*, its universality. In other words, the symbol in a discursive judgment aims finally to be used as a tool.

But while the judgment gains in exactness and universality by becoming abstract, it loses the appreciation of the wealth of individual experience which is present to the impersonal. We might compare the two in this way: The impersonal is individual, concrete, but inexact; the discursive judgment is exact and definite, but abstract, losing the warmth and color which belong to the indefinite.

This leads us to a further point in reference to the judgment. It would seem to be desired that we should get the full value of the concreteness and intimacy with reality which the impersonal asserts, and yet maintain the exactness of freedom which gives universality to the discursive judgment. Nor have we to go wanting. There is a stage of experience in which both sides are united, and in which in an immediate way we realize the full value of the individual side of our experience, while maintaining perfect exactness. In such cases the mind, indeed, works at its best. The stage I refer to is that of intuitive thought. We refer to it in other words as the expert judgment, and at other times realize it when we are "lost in our work," as we say. In all such cases

the mind is perfectly familiar with its material. Thought is most exact. The measures which in the discursive stage are used as symbols are still measures. The mind knows exactly what its measures are and the range of their application. Each problem is solved as it presents itself. No puzzling, no endeavor to refer is necessary. The whole is present as a whole, and with all its parts perfectly distinct and clear-cut. Complete immersion in the concrete detail and complete correctness concerning the nature and range of each measure are present. Perhaps the most characteristic examples of this experience are those of the artist (whether musician, poet, or what not) and the thinker when completely "lost" in his problem. When we say that the artist or thinker is "lost" in what he is doing, we do not mean that there is no consciousness of the material he has in hand. Quite otherwise. He is most certainly "lost" to the outside world, but he is most vividly conscious of that experience to which his mind is directed. To the musician there would be neither his own life nor music as such. It would rather become living music. Every part of the music is clear, definite, exact; but also every part is lived out and felt through and through. The expert shot may be said to make no discursive judgment. The bird rises in some particular direction; the estimation of distance, direction, and sighting are made practically instantaneously, or, as we say, altogether without thinking. Because he is so familiar with shooting and has made his symbols perfect tools, he can now act without hindrance and in such a way as to give a perfectly exact outcome.[1]

Thus in judgment we would seem to have two forms and three

[1] Of course it may be said that the expert type of activity is purely reflex and mechanical. It is a fact that actions performed consciously do become mechanical. But the reflex interpretation seems to be inadequate in the present case, and for the following reasons:

1. Actions which become reflex drop out of consciousness. It may perhaps be said that we get the value of the experience returned in terms of feeling. This is true. But the more deeply set in the organism the activity becomes, the less the conscious value appears.

Now, take the case of the musician. When he is lost in his music we cannot say that the value of the experience is merely felt, or that the process is purely mechanical, for it is, in fact, in such moments that he gets the full consciousness of every shade and turn of the technique of his performance and its outcome. Every turn of thought, every shade of emotion are present in consciousness and are immediately responded to in swift, clear thought and action. There is a difference between a player taken with paralysis who nevertheless goes on playing, and the football expert who notices every movement of his adversary and consciously meets the emergency. Outwardly

stages. The two forms are those of the immediate and mediate; the three stages those of the impersonal, the discursive, and the intuitive.

In the impersonal judgment an experience is immediately recognized, asserted, and felt as real. But although the experience is more or less definite, in that it is an experience, no exact measurement has as yet been introduced through the use of an exact symbol. But as the experience becomes more complex and definite within itself, and as greater demands are made, this symbol finally arises through the abstraction, isolation, and definition of some particular quality. In this stage of judgment the form becomes discursive. The whole cannot be measured immediately, but must be broken up into parts which are controlled by the various symbols. The symbols have reference beyond their own immediate existence. They indicate the particulars for which they stand, and build the meaning which they present into some consistent, definitely universal, but mediately recognized whole.

the two activities may appear the same, but inwardly there is all the difference of light and darkness between the two. In the one case there is simply a machine, and in the other a living personality.

2. We are forced to make a distinction between the thinker lost in his thought, yet to whom every shade and turn of the argument is clear, and the mystic who has driven every idea out of mind, and who has passed the subject-object stage. The thinker lives above the subject-object stage, the mystic below it. In the one case the mind is full of ideas, feelings, activities, the whole being is active and alive. In the other there is a dearth of ideas, a passivity of being, a mere existence.

3. The reflex interpretation of the intuitive experience fails to account both for the mental alertness of the musician, thinker, player, or sportsman, and for the rapid accommodation made necessary by the changing environment. The expert must "in a flash" size up each situation, and his expertness consists just in this. On the other hand, the paralyzed musician may play very delicately, but he must run along in the grooves of past experience. His behavior is like that of a locomotive which has lost its engineer. If the switches happen to be properly arranged, the locomotive will make wonderful excursions. But they must be arranged; itself can do nothing. So the activities of the musician may show themselves in many different forms, but they lack spontaneity and adjustment. This adjustment to individual experiences is characteristic of all stages of consciousness, but especially of the subject-object and the intuitive stages. There is this difference between the latter that in the subject-object stage we are trying to adjust ourselves, and in the intuitive stage we really succeed in the sense that we can perform the action immediately and without friction.

For these reasons it would seem that the intuitive stage is the unity of the subjective and objective phases of consciousness, and not their loss. And it would seem more reasonable. For if as action becomes perfected it disappears, and we never get the full value of the means in the end of the technique as technique, the process of experience would seem to be worthless and selfcontradictory.

Here judgment leaves out of account the individuality in existence of each particular, but through the symbol it becomes more and more exact, both in meaning and in reference, until it figures forth the universal in which the symbol has been wholly freed from the individuality of particular existences, presenting a meaning perfectly definite and identical with itself, and a reference which takes in the whole scope of its meaning and is, therefore, universal. Thus the discursive stands for perfect exactness and universality through complete symbolization or abstraction of certain qualities required for the particular references and indicated in the meaning, to the detriment of appreciation of the detail of individual existence. The impersonal fails in definiteness, and the discursive in appreciation. Both, however, are united in the intuition. When the discursive form has completed itself in the expert judgment which immediately and without reference recognizes the exact nature and range of meaning of their symbols, they pass over into the intuitive judgment. In this stage judgment realizes completely the individuality of each particular, and gets the full coloring which pertains to the particular. But at the same time the exactness and definiteness which are gained only through mediation of the symbolic stage are present.

Hence in the perfect form of the judgment the immediacy as well as the exactness and certainty of the earlier stages are represented. As immediate it has all the warmth, fullness, and glamor which pertain to any immediate experience, while as summing up the movement of the discursive stage it is inexact and universal.

To summarize this stage of our discussion: Judgment has to do essentially with the apprehension of meaning, the recognition of reality. In its earlier stages this apprehension takes the form of the immediate recognition of wholes which are definite enough to be used as centers of experience, but in which there is not yet a clear and exact definition of parts. The experience is apprehended as a totality. But this experience gradually becomes more definite within itself, until there is a necessity of adjusting the parts within one another in reference to the whole. Division arises. Qualities are abstracted from the whole and are used as symbols in terms of which the whole experience is measured. Through continued growth the symbols acquire definiteness, both as to their own meaning and as to their range of inference. The final stage is that in which the exact nature of the symbol is known, and its exact range of reference is also known. Where this is

the case, the identity of the symbol and the universality or completeness of its range are both known. This gives us the universal form of judgment. To most of us this identity and universality are purely formal, *i. e.*, we have learned to recognize that there is such a thing as identity and universality in judgment, but we practically never get within our own minds a complete and exact definition either of the nature of any of our symbols or of the exact range of their signification. In those few cases in which, in any department and in the minds of a few men, this identity and universality have been realized, with reference to any content, in these cases freedom in the manipulation and appreciation of the material is seen. But when this stage is reached — the stage of the expert judgment — there is no longer hesitancy in regard to the use of material, no retardation in inhibition. The content is fully appreciated in its individuality of coloring and existence, and is also grasped in the exactness, identity, universality, and perfect placing of the material. That is, once more the division into subject and object disappears, and we are in the presence of an immediately recognized reality. But it is immediacy which differs from the impersonal in that it is definite and universal, whereas the earlier experience was indefinite and individual. Thus the discursive judgment logically arises out of and returns into the immediate judgment. In the discursive stage the judgment must be twofold, but in both the impersonal and intuitive stages subject and predicate disappear. In the impersonal stage they have not yet been differentiated, while in the intuitive they disappear into an exact and immediately recognized whole.

II. SIGNIFICANCE FOR PSYCHOLOGY.

When once we have clearly in mind the fact that the discursive judgment arises out of the impersonal and tends to pass over into the intuitive or expert judgment, the significance of the impersonal in the construction of our theory of the development of consciousness becomes exceedingly important.

The impersonal judgment points to a state of consciousness in which all experience is recognized as a totality, and not by conscious mediation of the parts. The discursive judgment, in which the subject and predicate appear, and in which immediate recognition passes over into mediate recognition, indicates not a totality, but a whole. It grasps, or endeavors to grasp, through the definition and conscious reference of part to part. Consciousness is split up, a dualism appears

within it. The movement involves every phase of consciousness and is most fully expressed in the opposition of subject and object, of the known and the unknown. Finally, this opposition, which occupies us almost exclusively, is never consciously transcended, except in a few rare moments when we lose ourselves in our thought or actions. But in so doing we maintain clear and definite consciousness, while feeling ourselves absolutely one with our content or experience. Judged from an *a priori* standpoint this logical relation in the judgment would seem to point to the origin of the subject-object consciousness out of a state of consciousness identical with that given in the intellect. The impersonal judgment, on the other hand, tends to pass over and find its complete fulfillment in a state of consciousness where the meaning of subject and object is contained in a higher state of consciousness, but a stage which is clear, definite, expert, but not discursive.

The facts bearing on the origin of the subject-object consciousness should be found (*a*) in child psychology, (*b*) in race psychology. The evidence to be adduced for the development of self-consciousness into a higher phase should evidently be found in adult psychology, if anywhere. The first two points, when developed, should give us insight, not only into origin and function of the subject-object consciousness, but should also add insight to the arguments in favor of the theory of the impersonal advanced above.

1.[1] The child enters life apparently at a great disadvantage when compared with the young of animals. They soon learn to perform the movements and to engage in the activities peculiar to their kind. Children, on the other hand, have to serve a long apprenticeship before they can take part in the simplest distinctively human activities. But although this is so, the human animal is born into the heritage of a social and psychical environment which makes him rise far above all others. In short, the child life furnishes us with a magnificent example of growth from very small to very great and complex things.

In examining the stage of this growth, our attention must necessarily be directed chiefly to the development of the child's longer age. Here we get the expression of the child's thought in definite, concrete forms, and while reference to other phases of the child's activity will not be omitted, our point of view is necessitated from the fact that we

[1] In whole section *cf.:* Tracy, Psychology of Childhood; Preyer, Development of the Intellect; *idem*, Development of the Will; Perez, First Three Years of Childhood; Moore, Mental Development of a Child; Baldwin, Mental Development.

approach the whole subject in connection with one aspect of the judgment.

During the first six months of life the infant does not make any appreciable advance in language. He, as it were, is simply soaking in his environment. His speech consists simply of spontaneous babbling produced automatically by impulsive exercise of his vocal muscles. One of the most interesting things in connection with these early sounds is the wide range of their compass. All shades of emotion are expressed in forms incapable of repetition as the child grows older. Gradually out of this strange prattling mass definite sounds come to be distinguished; vowels usually precede consonants. These are repeated over and over again, stimulating themselves, until long before the sixth month syllables arise. At this stage reduplication plays a great part; for instance, "ma" becomes "mama." This shows that the activities involved in making these sounds tend to continue and stimulate themselves. This has been called the "circular form of reaction." Indicative of the above mentioned form of activity, vocal imitation arises. At first it is vague and shadowy, suggestive and impulsive, rather than clearly directed and controlled.

In the second six months imitation becomes all-absorbing, and consequently words begin to be used with meaning. The vague and shadowy form of imitation which characterized the first six months gives way to a more definite form. Simple imitation tends to pass over into the persistent form. With this growth in imitation comes an increased power of attention. In early life the child's attention is almost altogether at the mercy of external circumstances. But through imitation control is developed, and the child is enabled to continue doing something suggested.

At this time, also, the child commences to recognize members of the household by name and to recognize parts of his own body. This shows us that a period of quite extended duration is required before there is developed out of the undifferentiated whole of early experience the consciousness of definite experiences and of definite objects. This statement, which is true of all sides of the child's life, is beautifully illustrated from the side of language. Taine, in speaking of the acquisition of language by his own child and in dealing with this period, says:[1] "As yet she attaches no meaning to any word she utters, but there are two or three words to which she attaches meaning when

[1] *Revue Philosophique*, No. 1; *Mind*, Vol. II, p. 252.

she hears them. She sees her grandfather every day, and a chalk portrait of him, much smaller than life, but a very good likeness, has often been shown her, from about two months. When asked 'Where is grandfather ?' she turned to this portrait and laughed. Before the portrait of her grandmother, not so good a likeness, she made no such gesture and gave no sign of intelligence. From eleven months, when asked 'Where is mamma ?' she turned toward her mother, and she did the same thing for her father." Here we have intelligence and recognition. The "big, buzzing, blooming confusion" of early life has gradually passed into the recognition of experiences separated out from the undifferentiated totality and forming more or less definite centers. But we must not suppose that in these experiences we have anything more than situations immediately recognized and grasped in their totality. Taine continues: "I should not venture to say that these three actions surpass the intelligence of animals. A little dog understands as well when it hears the word 'sugar;' it comes from the end of the garden to get a bit. There is nothing more in this than association: for the dog, between a sound and some sensation of taste; for the child, between a sound and the form of an individual face perceived. *The object denoted by the sound has not yet a general character.*[1] However, I believe a step was made at twelve months. Here is a fact decisive in my opinion. This winter she was carried every day to her grandmother who showed her a painted copy of a picture by Luini, of the infant Jesus, naked, saying at the same time, 'There is bébé.' A week ago, in another room, when she was asked 'Where is bébé ?' meaning herself, she turned at once to the pictures and engravings that happened to be there. Bébé has then a general signification for her, viz.: what ever she thinks is common to all pictures and engravings of figures and landscapes—that is to say, if I am not mistaken, something *variegated in a shining frame. In fact, it is clear that the objects painted or drawn in a frame are as Greek to her. On the other hand, the bright square enclosing any representation must have struck her.*[1] This is her first general word. The meaning she gives it is not what we give it, but it is only the better fitted for showing the original work of infant intelligence. For if we supply the word we did not supply the meaning: the general character which we wish to make the child catch is not that which she has chosen. She has caught another suited to her mental state, for which we have no precise word."

[1] Italics mine.

This quotation will make clear to us that in this recognition by the child we have no reference at all to definite objects. Taine himself admits this. All that existed for the child's mind was simply a definite image, which she recognized, and which we call something "variegated and in a shining frame." But if this be so, there can be no meaning in speaking of the child's image at this stage as a general idea. We cannot truly speak of an abstraction, for as yet the only definite thing is the recognized experience. In it there is no reference of an idea beyond itself, no separation between existence and symbol. What we are inclined to call the symbol can be no symbol, for it is the only reality definitely recognized by the child. In short, to speak at this stage of a general image in any sense in which it can be used as a symbol is incorrect. It is a case of the psychologists' fallacy. To the child there is neither a particular nor an idea. *We* distinguish different things, and recognize that we abstract certain qualities which are used as symbols or signs of these existences. But, as we have seen, there is no distinction of objects to the child at this stage. Hence, there can be no abstraction of qualities in any sense in which they indicate some object. In short, the vague and schematic image is all the object there is, so that it cannot stand for anything else. We do put it otherwise to the child, and there is one stimulus and one reaction in the experiences which we adults regard as different.

The above interpretation throws great light on the child's development between the twelfth and eighteenth months. As we should expect, there is a marked progress in the understanding of words, and in their intelligent application. In longer words children reproduce the important part alone, and they now begin to express themselves in sentence words. But perhaps the most interesting feature of all is that the childish concept endeavors to make itself exact and definite.

On this point Tracy says:[1] "But perhaps the the most interesting thing of all this time is the gradual 'clearing-up' of the childish concepts, as indicated by the steady circumspection of the application of names. Even yet, however, names are applied much too widely; much more experience is necessary before they acquire in the young mind a clear and definite connotation. It is interesting, also, to note how the principle of association enters as a factor in the determination of the application of the name. When the child calls the moon a lamp, or applies his word 'bô' (ball) to oranges, bubbles, and other

[1] Psychology of Childhood, p. 73.

round objects; calls everything 'bow-wow' which bears any sort of resemblance to a dog (including bronze dogs on the staircase, and the goat in the yard); applies his word 'papa' and 'mamma' to all men and all women, respectively; makes his word 'cutie' do duty, not only for 'knife,' but also for 'scissors,' 'shears,' 'sickle,' etc.; says 'bå' (bath) on seeing a crust dipped in tea; applies 'ati' (asses) to 'chair,' 'foot-stool,' 'bench,' 'sitting down,' 'sit down,' etc.; it is evident *that one great striking resemblance has overshadowed all differences in the object.*"[1]

This whole paragraph illustrates the point which we made above in regard to the "concept." The childish "concepts" are no concepts at all. Differences exist in the objects only for us. Hence, what we take to be the reference of a vague recognition of similarities in objects to different objects, is not all indicative of the true state of things in the child's mind. What he really has in mind is an indefinite image. Given stimulations which have any similarity at all, as we conceive them, the child interprets in one way. That is, to the child there is but one stimulus, one reaction, one object, viz., an experience sufficiently differentiated to be grasped as a totality, and to be recognized in and through itself. The child has not yet got to a stage where its experience, or life, is sufficiently differentiated to admit of a conscious recognition and reference of parts in a whole. This stage, however, is reached in some children just before the end of this period. Short sentences are used, in which only the prominent ideas appear. The full meaning of the stage is seen in the period ranging from the eighteenth to the twenty-fourth month. ,Preyer records at this period, "the greatest progress, however, is indicated by the combination of two words into a sentence." The two words really used are a noun and a verb. Here we see that the immediately recognized situation which was formed out of the chaotic totality of early conscious experience has itself become so differentiated that unity in differences must be consciously recognized within the former totality. A dualism has appeared, which is represented on the intellectual side in the discursive judgment through the development of the nominal and verbal tendencies.

But this is not all. Simple imitation, which was expressed in the circular reaction of early life, gradually passed over into persistent imitation. This, when once differentiated, developed rapidly, showing itself in the more complete apprehension of meaning, and in the development of control. In this period an independence of activity quite

[1] Italics mine.

strong and marked showed itself. The ambition of the child was aroused, and he desired to go his own way without hindrance. It is evident from this that we have here to do with the dawn of self-consciousness in the child. That is, we begin to see traces of the recognition of self as self at the time when the impersonal form of expression begins to pass over into the discursive judgment.

Thus the analysis of early child life directly confirms the account of the impersonal judgment given above, with the added fact that the passage from the impersonal to the discursive judgment is indicative of the development of self-consciousness in the child.

Now, if these things be so, some trace of this process should also be found in the differentiation of the subject-object consciousness in the race. If we turn our thought to the development of language, we should expect to find the different parts of speech disappearing, first, into a twofold movement expressive of the nominal and verbal tendencies, and, secondly, into a stage in which meaning is represented by a form of thought corresponding to the impersonal. At the point where this impersonal stage of thought passes over into the discursive judgment we should expect to find the passage from the animal consciousness into the human.

2. In entering upon this division of our subject, a distinction must be made between the science of language and the science of thought.

The Science of Language observes and systematizes the various facts and forms of language, and seeks to formulate the laws by which it has been and is governed in its transformations. It seeks to understand the vehicle of thought, not as a vehicle, but in itself.

The Science of Thought endeavors to investigate the psychological aspect of the subject-matter presented by the Science of Language. Language as a vehicle is made to contribute to the understanding of the thought of which it is the vehicle.

Now, in this procedure it would seem that the Science of Thought is dependent upon the Science of Language, and must wait until the latter has handed in its results. This is true to a very great extent. A Science of Thought cannot be manufactured or spun out of our heads, and inasmuch as it endeavors to construct the thought movement, it must await the elucidation of the forms in which past thought has expressed itself. But although the psychologist may depend upon the comparative philologist for material, it is as material that he receives it, and he may feel himself free to interpret the facts as an understand-

ing of them from the psychological standpoint may demand. Just as the philologist, on the historical side, demands that he should be free from all interference from psychologists while investigating the facts and forms of language, so just as truly may the psychologist demand that the philologist should give simply the results of his labor as material and spare the advice which is so often given.

As there has been evolution in the physical and organic worlds, so there has been evolution in the conscious world. Of this the development of language[1] is one of the most evident proofs. As civilization has advanced, language has been continually refined, until the efficient and graceful instrument which we find in more advanced nations in both past and present has been produced.

It may further be noticed that the earliest stage of language which the philologist can reach is still immeasurably far removed in time from primitive human speech. But although the barrier of time can never be overcome and we can never present the primitive language, still, from the nature of the development within language itself, we can form a quite trustworthy opinion of what its psychological nature must have been. This, however, is to presuppose the result of our analysis, to which we must now proceed.

In the unity of the discursive judgment (recognized by all and considered by most to be the only true form of judgment) two movements are usually distinguished — that of the subject and that of the predicate. These united in the copula represent the content of the unified thought. In these two movements certain distinctions are now made: nouns, adjectives from nouns, adverbs, etc. But while these various distinctions are recognized by philologists, it is emphasized that they were not always as clearly worked off as they now are. As we go backward in the history of language, the differences which distinguish the nominal and verbal movements begin to disappear. Not only do the differences in the inflectional forms disappear, but also the two movements themselves become confused. In certain cases nouns are derived from verbs and verbs from nouns. For this reason endeavors have been made to reduce nouns to verbs, and *vice versa*. But the general consensus of opinion now seems to

[1] *Cf.* Paul, Principles of Language; Brugmann, Comparative Grammar of the Indo-Germanic Languages, Morphology, Pt. I, p. 2; Max Müller, Science of Language and Science of Thought; Sayce, Introduction to the Science of Language; Delbrück, Introduction to the Study of Language; Giles, Comparative Philology.

be that so far language does not admit of this reduction. As far back as we can go the two movements remain, the one as distinct as the other. But contained in both nominal and verbal stems there has been a unity, which seems to indicate that they arose out of one original form. Concerning this point a great deal of controversy has arisen, and the end is not yet. Those who follow the Science of Language most closely, and to whom philology is purely formal and historical, insist that there is no reason to suppose that any root form which we have is original and indivisible; *e. g.*, Brugmann says:[1] "Strictly speaking we are never sure in the case of a suffix which has come down to us from the Indo-Germanic parent language, whether it ever existed as an independent word, exactly in the same shape as we extract it from the body of the word, or whether it originally consisted of elements which passed into this shape by a regular phonetic change. It is theoretically correct when we say that the root of a word is found after we have removed all formative syllables from it. But in the first place, we do not know what shape Indo-Germanic words had toward the end of the root period, and this applies especially to the fact that we are unable to say whether the language at this stage possessed only monosyllabic, or only polysyllabic, or words of both categories. Secondly, the analysis of elements which were directly annexed to the ends of roots is of a most doubtful nature. And, lastly, we are unable to determine what phonetic changes inflexional compounds had undergone from the beginning up to the dissolution of the primitive community. Hence, it must not be supposed that the roots which we in ordinary practice, abstract from words are at all to be relied upon, as representing the word forms of the root period. We are utterly unable to understand, *e. g.*, whether the complex *a. n. ə.* represents a unitary word of the root period, or whether it is to be resolved into *a. n. ə.*, that is, whether *ə* was a suffix and thus originally an independent element. Such being the state of things, we shall retain the terms root and suffix in this work for such part of the word as 'seq' and 'e,' 'tai,' 'sequetai.' . . . .

"We do not, however, assert that the elements to which we give these names ever existed as independent words. We merely indicate by means of hyphens (-) what was probably felt at any particular period as the nucleus (so to speak) of the whole system of word

[1] Comparative Grammar of the Indo-Germanic Languages, Morphology, Pt. I, pp. 13–18.

forms — 'seq' and "e," what was regarded as the formative element."

It is evident from this that the root has been taken in a purely formal way and from the standpoint of the Science of Language, as dealing simply with the facts and laws of linguistic transformation. It is just what would be expected. There is no reason to suppose that the word forms which we are able to obtain from any known language are primitive and indivisible. It is the same here as in child language. The external forms may be divided and subdivided, until the external, formal root or generalized concept as expressed in language has disappeared into the crudest articulations. From the historical and formal standpoint it may be said that the death blow has been given to any system which would abstract any root and say that it was the primitive form.

But the matter ends here only from the purely formal and historical standpoint. The logical consideration of the formation of roots still remains, and there seems to be no doubt, even among philologists who emphasize the historical side, that a root period existed. What this root period stood for, and what its general nature and formation were, is a further and legitimate question. And, further, it is not to be supposed that it is our purpose to indicate what particular meaning primitive roots had. Rather, it must be our endeavor to find out whether it is more natural to suppose that the nominal and verbal stems are ultimate, and, therefore, the root purely ideal, or whether the root was the real unity out of which the nominal and verbal stems differentiated.

Even in Brugmann we find the conception that the root is a nucleus or kernel around which the thought in the nominal and verbal stem centers. Further, it is now agreed that as far back as we can go the two forms of stem begin to shade into one another. Now, if we carry this thought back far enough, we see that the nominal and verbal stems must gradually become less clearly differentiated from one another, until finally they disappear into an experience in which meaning is grasped in what we have called a situation or totality, as represented in the impersonal judgment. How many of these roots there were, and what their particular meaning was, we cannot say. Nor need we concern ourselves about it. All that interests us is the function which this root stage played in language.

Here we may make a quotation from Delbrück,[1] which deals directly

[1] Introduction to the Study of Languages, pp. 77 ff.

with the idea of roots. He says: "Bopp derived from the grammatical tradition of his time the principle that the whole word material of a language must be traced back to roots. However, he did not express any opinion whether or not those so-called roots shall be regarded as real linguistic structures or only as abstractions of the grammarians. But Pott says: 'Roots are the chieftains of a word family. They are the unity, the pyramidal points, in which all members of such a family terminate. Only composites can, like married pairs, belong to two families. Roots are, furthermore, only imagined, as mere abstraction; in reality there can be no roots in language. Whatever may wear the outward appearance of a pure root is a word or a word form, not a root; for a root is an abstraction of all word classes and their differences—a possessing of them without refraction. A root is not like a letter or a syllable simply. It is also the unity of meaning of words and forms which genetically belong together, and at their creation were present as prototypes in the soul of the language maker. When not wholly obscured, it is felt more or less plainly by every speaker in connection with the language which he uses.' Add to this: 'Roots are ever mere ideal abstractions necessary to the grammarian in his calling, which he must nevertheless extract from language in strict conformity with the given reality.' Pott accordingly denies that roots can have existed before the inflectional form. If now it must be asserted that declension arises in the Sanskritic languages by the affixion of inflectional suffixes to the fundamental forms of the noun and conjugation through the affixion of others to the root or stem, this must not be understood to imply that the fundamental form and the root are something existing independently and out of connection in language, or something, as it were, present in language before inflection. What is really meant is only that the fundamental form is contained in all the cases of nouns, and the root in all verbal forms, as that which is still undifferentiated, as that which is common to them, which grammatical analysis alone for scientific ends tries to free from all the differentiated characteristics united with them, and to display in all its simplicity. *This definition of Pott is correct in so far as it rightly defines the position a root occupies within a finished inflectional language. But it is one-sided, inasmuch as it does not state how the roots arrived at this function. To this question only one answer is possible from the standpoint of Bopp's hypothesis. If the prototypes of the now existing inflectional forms really arose by means of composition, especially the proto-*

types of forms of the finite verb, by composition of a verbal with a pronominal root, then the root must have existed before the word existed. Roots are contained in words because they existed before them, and were merged in them. They are the words of the pre-inflectional period, and vanish with the development of inflection. Therefore, from the standpoint of the perfected inflectional speech, what was once a word appears only as an ideal center of meaning. This wholly intelligible and consistent view of the root may be said to be universally accepted at the present day." [1]

Pott was forced to believe that the root was really a center of meaning. But this center he believed to be purely ideal. That is, although the roots were present in the minds of primitive men and were copied in language, there was nothing corresponding to them antecedent to the early stems and expressed in language. That is, the roots were to Pott virtually concepts innate in the primitive minds and regulative of early language.[2] If this were so, they must have been empty and formal. That is, all difference would fall on the side of the linguistic stem and the unity on the side of the concepts. But if the concepts were empty, there could be no distinction within them. Consequently, they could not be distinguished one from another; nor could they be applied to particular thoughts, for there would be no reason within them why they should be applied to one rather than to another. That is, Pott abstracts the unity of movement present in early thought and sets it over against the particular differences which have been differentiated. A true view is to note that the unity present in the early thought gradually becomes less and less clear, until we are brought to a stage in which a meaning existed, but not a meaning indicative of different objects consciously presented. This meaning existed in totalities of experience immediately recognized. And in this sense we see that, as Delbrück says, roots may be consistently and intelligently maintained.

Thus the study of language brings us to the same result as the study of the child. The discursive movement given in self-conscious thought and language disappears into a form of thought in which experiences identical with those which are expressed in the impersonal judgment appear. And not only so, but we have seen that the passage from the impersonal to the discursive form of thought occurs in the earliest stages of distinctively human life. That is, as far back as we can trace a distinctively human experience, nominal and verbal stems

[1] Italics mine.

[2] *Cf.* Max Müller, *op. cit.*, p. 110.

are found. But these point on to an earlier and more primitive stage of root forms or impersonal thought. Once more we find the passage from the impersonal to the discursive form of thought co-eval with a passage from a merely conscious stage to a stage in which the opposition between subject and object begins to appear. Impersonal judgments, as it were, begin to appear just below the threshold of what we ordinarily term self-consciousness, and on the threshold itself. In short, they seem to form the connecting link in thought between animal and human intelligence, as well as indicating the form of experience in which the differentiation as a whole is made.

This conclusion to which we have been led through the investigation of the impersonal judgment should be compared with certain results reached by Romanes from the standpoint of comparative psychology. From a close study of animal life he was led to believe that a definite type of thought was present in the life of the higher animals. Through this "receptual" thought, as he designated it, the life of these animals was distinguished, on the one hand, from mere sense-experience, and, on the other hand, from the self-conscious life of man.

When we inquire into the nature of this receptive process, we find that it corresponds exactly to what we have shown to be the true nature of the impersonal judgment. It distinguishes itself from sense-experience in that it is composite, taking up into itself the results of past experience. It is distinguished from distinctively human experience in that it is immediate merely. Differences are felt rather than abstracted. This we have found to be characteristic of the impersonal judgment, the childish "concept," and the racial root. The agreement in outcome thus materially strengthens each position, and forces us to believe more strongly than ever that in the impersonal we have the original form of judgment and the connecting link between the conscious and the self-conscious stages of experience.[1]

SUMMARY AND CONCLUSION.

There remains the task of a brief recapitulation of the general movement and outcome of our investigation.

Previous investigations of the impersonal judgment have been unsatisfactory because of a general presupposition in regard to the

[1] A criticism of Romanes' position at once suggests itself. To him the order of succession in thought is that of percept, recept, concept. For reasons which will be evident from the whole standpoint of the essay, percept and concept arise together.

nature of judgment. According to the traditional view, all judgment must be discursive and must contain a subject and a predicate. The traditionalists are right in maintaining that we cannot separate the subject from the predicate, for it is self-contradictory to assert that we may have predication of nothing. But they are untrue to scientific procedure when they maintain that all judgments must conform to the discursive type. A form of judgment in which neither subject nor predicate appears would obviate entirely the difficulty raised in regard to predication. It has been felt from earliest days both that impersonals are real judgments, and that they do not conform to the ordinary type. The search for a subject has shown the fruitlessness of the attempt, for either no subject is found or we must warp the natural meaning of the proposition.

When we lay aside all presuppositions and examine the impersonal form of expression on its own basis, we reach the following result: In its essential form the impersonal is the immediate recognition and assertion of an experience, in which the whole is recognized in its totality and not through its parts. But this totality gradually differentiates, until recognition of the whole can take place only through the parts. Here the discursive judgment appears. Now, inasmuch as we cannot assert at just what moment the immediate form of the impersonal passes into the discursive judgment, a mediate form appears, in which the symbolic subject indicates a content, however vague it may be. Here, again, growth changes the experience, until a definite, particular subject appears, and we have the full-fledged discursive judgment.

This point of view enables us to harmonize the various divergent types of theory. We can account for all the facts which they present without doing damage to any. We are enabled to see how those who asserted that the experience was individual and concrete had ground for their assertion, while at the same time admitting that those who maintained that the experience pointed to something general and universal had equal right to their opinion. Also, we are enabled to remove contradictions from both views by finding either that both subject and predicate are lacking, or else that both appear in a vague, schematic way.

As Kant says, percepts without concepts are blind, and concepts without percepts are empty. Each is meaningless when taken alone. Percepts present us with the discriminative side of the discursive process, while concepts give us the side of unity. We cannot have the one without the other.

But if this be so, our analysis is of great importance both for logic and psychology.

The most significant point as regards logic is that the ordinary view of the nature of judgment must be radically remodeled. The discursive form does not exhaust judgment. The discursive judgment arises out of an immediate concrete judgment and passes into an immediate concrete judgment. When the impersonal experience has differentiated to such an extent that, instead of a buzzing confusion, more or less definite centers of experience appear, these are recognized and asserted in their totality. When these in turn have become so full of content that friction arises within them, the parts are abstracted, and the whole is mediated through them. The parts become symbolic of the whole. But, again, when differentiation has proceeded so far that the symbols may be used with exactness as regards their own nature and the extent of their reference, friction disappears, and we have once more an immediate stage in judgment. This, however, distinguishes itself from the impersonal judgment in that the whole is recognized through the parts, and both whole and parts are exact and definite.[1]

[1] Further implications of the impersonal are apparent.

Much has been said concerning the relation of impersonal and existential judgments. From the standpoint of our analysis all judgment is existential. The impersonal takes its "totalities" for existences, the discursive judgment endeavors to make apparent the nature of the existence assumed in the impersonal; while in the intuitive stage there is a definite assurance that the experience recognized is real. The different forms of judgment are thus stages in our recognition and exposition of existence.

But this, again, involves the nature of belief and its relations to judgment.

In all judgment there is an element of belief, whether in the forms of primitive credulity, of belief struggling through doubt, or of belief so thoroughly assured that its "what" and "why" are ever ready.

Again, judgment mediates and grounds belief, while belief connects all judgment with reality. The criterion for the truth of judgment must be the criterion for the worth of belief. To say that all judgment is existential is, therefore, but to say that thought as such believes that it has to do with reality.

Such a view would lead us to believe that since all judgment is recognition or assertion of reality, that the criterion for the truth of judgment, and the worth of belief, cannot lie in judgment or in belief. Judgment and belief both land us in the hypothetical stage. How do we pass to verification? If the scientific position be true, all verification comes through action—the testing of our hypotheses by crucial experiments. Judgment and belief simply prepare us for action. In this preparation judgment provides the mediation; belief, the motive. Through thought we become convinced or believe that reality is such as we take it to be, and that, if we act according to our belief, we shall gain certain experiences defined and expected

Turning to psychology, our outcome has been that the impersonal judgment forms the connecting link between conscious and self-conscious experience in the adult, the child, and the race.

Conscious experience begins in vague indefiniteness, and it is long before any definite image or center is recognized. But images or centers as totalities do finally appear. These become more definite and overlap in the unity of the life mediation; then the mind is forced to the recognition of wholes through their parts. This recognition of wholes brings to clear consciousness the nature of the activity as a unity amid differences, as a process making use of means and ends. In short, consciousness now becomes self-consciousness. All further development is that of the personality which has been produced. It is a process working by means and through ends. When the recognition of the means for any end has become perfect, and we can immediately control them, the richest form of self-consciousness in what we have called expert action appears. Whole and parts, end and means, subject and object, are one definite, unified existence. Such states may, perhaps, be rare, but they are seen in the musician lost in his music, in that perfection of thought in which we are lost to all about us, in the expert player who in the midst of the game must constantly adjust himself to new conditions.

in thought and belief. If we do get them, then, we take it, our thought is true, and our belief is assured. But this means that we have come back to experiencing, through experience defined, directed, and tested. Of this direct experiencing both judgment and belief are phases.

Now the question comes, What is the relation of the Real to the fact of experiencing? Is Reality Experiencing? This opens up a fundamental metaphysical problem. The aspects of the problem twine and intertwine, and seem to find their origin and outcome in the impersonal and intuitive judgments.

This point of view suggests a further problem, viz., the development of the self from mere experiencing through the impersonal and subject-object stages to the intuitive stage of which we are conscious at times.

Our view of the judgment would suggest the reduction of thought, action, and impulse to one developing life movement. The inner nature of this movement would be given in an analysis of the different stages, while the process of growth would be best seen by a section of the various layers.

This, however, is a further problem.

President Angell with Professor Angell

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STUDIES

FROM THE

PSYCHOLOGICAL LABORATORY

DIRECTED BY

JAMES ROWLAND ANGELL

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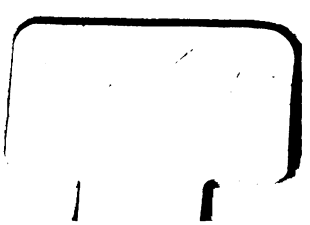


INTRODUCTORY NOTE.

It will be observed from an inspection of these studies that the point of view dominant in the conduct of our laboratory work has undergone no radical change since its formulation in connection with an earlier series of papers.[1] Without attempting a restatement, it may be said to involve emphasis upon the genetic and functional standpoint, whose neglect by the experimentalist must be as disastrous for him as it has already proved for his predecessor, the pure introspectionist. The disappearance of the faculty psychology, with its static categories, has been followed by the slow extinction of the static psychological "element." The work of the contemporary experimentalist is also certain of extinction if he fails to heed this writing on the wall. Our attitude does not involve any undervaluation, much less rejection, of the more usual type of psychological analysis. On the contrary, we regard such analysis as indispensable; but we maintain that it should be executed in such a manner as will display, in place of disconnected mental fragments, a real conscious organism at work and growing as it works — in short, display it as alive. The several studies in this volume naturally reflect this principle in very different degree, a fact which finds its obvious explanation in the subject-matter of the various investigations.

The last four articles are reprinted from the pages of the *Psychological Review*.[2] They appear here unchanged. Professor Buck reports upon some interrupted experimentation, whose resumption in the near future appears out of the question. The results already gained seem, however, sufficiently suggestive to warrant their publication. Dr. MacMillan describes a new method for studying the growth of habit, together with certain results thus far attained.

We regret exceedingly that it has been found impracticable to print at this time, as was fully intended,[3] more complete tabular reports upon the experiments on visual and cutaneous space. The purpose in view

[1] See Introductory Note to University of Chicago Contributions to Philosophy, Vol. I, No. 1.

[2] *Psychological Review*, Vols. V and VI.

[3] See footnote, p. 589.

was simply to produce additional evidence in support of the reported observations. The diagrams on pp. 587 and 591 show a few relatively large fluctuations in the judgments upon certain closely adjacent stimuli. This naturally suggests inconstant conditions, but the records show such small variations[1] for any given stimulus, even after the lapse of considerable intervals of time, that the fluctuations seem necessarily attributable to intrinsic peculiarities in the psychological processes, and not to errors of procedure and control. In any event, it is the general tendency reflected by the whole series of stimuli which is important and significant, rather than the apparent irregularities attaching to any one, and this tendency is demonstrated by the experiments with great certainty.

[1] See footnote, p. 589.

OBSERVATIONS ON THE OVERESTIMATION OF VERTICAL AS COMPARED WITH HORIZONTAL LINES.[1]

ALBERT F. BUCK, A.M.

The experiments here reported were undertaken with the purpose of investigating the relative importance of movements of the eyes in the production of the familiar illusion of overestimation of verticals as compared with horizontals. It will be remembered that this illusion has often been referred to the supposedly greater amount of muscular effort involved in moving the eyes over a vertical distance, this excess of muscular effort being in turn referred to the anatomical and physiological peculiarities of the eye, whereby horizontal movements are executed by two muscles and vertical movements by three.[2] Another form of explanation, not necessarily exclusive of the first nor wholly excluded by it, is based on an asserted compensation in our judgments for certain optical disparities in the dimensions of objects. This doctrine emphasizes the fact that the field of view is of such a character as commonly to render the upper half of it relatively too short in the vertical plane.[3] It is said that the illusion does not obtain for large distances, but it is sufficiently obvious in the distances upon which the observations of this investigation are based. The illusion varies in different figures and disappears entirely in the circle.

It was suggested by Mr. Angell that, if the illusion were entirely due to eye movements, or even in large measure of such origin, although possibly involving other elements, it might be feasible, by changing the position of the head and body, to produce a translation of the illusion through as many degrees of arc as the body was turned. If the illusion were wholly muscular in nature, this would, unless some factor previously inoperative came into action, finally result in making

[1] See Introductory Note.

[2] Cf. Wundt in *Philosophische Studien*, Vol. XIV, p. 70.

[3] Cf. Helmholtz, Physiol. Optik, Eng. trans., p. 702. Lipps has offered an explanation in terms of æsthetic preferences and tendencies.

The literature on optical illusions has grown very rapidly in the last few years. In a confessedly fragmentary statement of this sort extended references would be out of place. Lipps' Raumaesthetik und geometrisch-optische Täuschungen, 1897, appears to be the most complete thing.

the horizontals seem longer than the verticals, or at least greatly reduce the disparity between them. In short, the illusion should show a tendency to follow the direction of changes in the position of the eyes relative to the visual field, provided it rests upon muscular processes. A brief statement concerning apparatus and procedure will lead to an account of the results observed and their seeming implications.

The apparatus consisted of a vertical screen about a meter square, covered with lusterless black cloth. Through a small hole in the center of the screen ran two light-gray cords, having their ends wound with black silk thread, which was carried over the edge of the screen to the back. The cords had counter-weights at both ends to keep them taut. In the experiments the two cords or lines formed always a right angle. The two positions in which this right angle was placed are represented graphically thus, ⌜ ⌞. The tests were divided between the two positions.

The experiments were conducted in the following manner: One of the cords was placed in the vertical position, the other in the horizontal. Then, by the method of minimal change, the cord that was obviously the longer was shortened until a judgment of equality was given; it was again shortened until a judgment of difference was reached. The cord was then made obviously shorter, and lengthened according to the reverse procedure. The fixed cord or line was always 20^{cm} long. Half of the tests each day were taken with the subject sitting erect; half when the subject was lying on his side on a table. Particular care was taken that the point midway between the eyes was always directly opposite the opening in the center of the screen where the two lines met. The experiments extended over six weeks, and involved some 2,500 judgments, distributed about equally between each of two subjects, who were kept from the first in ignorance of the errors being made.

It was thought wise to ascertain whether the illusion varied when the absolute length of the lines varied. Instead of changing these lines, it was found more convenient to vary the distance between the subject and the screen. Hence in half of the experiments the distance was 60^{cm}, in half 120^{cm}. The subject made each day about eighty judgments in all. Of these at least eight were judgments of just perceptible sameness or difference.

It may be added that, owing to the procedure adopted, it is easily possible by a simple computation to deduce the discriminative

sensibility, to which reference is made in a later paragraph. This obviates the necessity of separate tests, and is in many ways of considerable advantage. The computation may be described as follows:

The number that expresses the overestimation of the vertical is itself the average of two different averages. The one of these averages is computed from the judgments of sameness and difference when the changing line is longer than the constant; the second from such judgments when the changing line is the shorter. The fraction whose numerator is the difference between either of these averages and the final average, and whose denominator is the final average itself, measures the discriminative sensibility.

In presenting the results of the experiments no attempt will be made to offer complete tabular reports. Although the average variation was in every case small, the absolute number of tests makes emphasis upon the exact quantitative features of the results somewhat unsafe.

In the normal erect position subject *M* overestimated the verticals at 120^{cm} 1.2 per cent.; at 60^{cm} the overestimation was .8 per cent. For the same conditions subject *B's* overestimations were 6.2 per cent. and 5.3 per cent. respectively. In the recumbent position upon the side *M's* overestimations increase slightly for both distances, the figures being 1.3 per cent. in each case. *B's* overestimations also increase, being 8.1 per cent. for 120^{cm}, and 6.8 per cent. for 60^{cm}. In both subjects, therefore, the increase in the illusion is about 30 per cent. for the recumbent position. It will be noticed that the illusion is much more marked in one subject than in the other. Although the degree in which the illusion was felt varied considerably on different days, the judgments upon any one day were always quite constant. Thus, for subject *M* the variation for any one day never ran above .004 per cent. in the erect position, nor above .005 per cent. in the recumbent position, the average for the whole experiment being about half these amounts in each case. Similarly, the maximum variation upon any one day for subject *B* was .004 per cent., and the total average .002 per cent. in each position. It will also be observed that the illusion is slightly greater at 120^{cm}, which accords with the assertion that the illusion is felt less with longer lines.

In one particular the two subjects show a distinct difference. *B's* overestimation of the vertical is markedly greater when it constitutes the fixed stimulus and the horizontal varies. *M's* overestimation is,

on the other hand, much greater when the vertical is the changing stimulus, which seems to be the case with most other observers. The amount of this difference is not so significant as the fact that any constant difference of the kind exists at all. It points to a probable difference in the habitual focus of attention in the two individuals.

When the horizontal is at the top of the vertical, the overestimations of *B* are uniformly larger than when it is at the bottom. *M* shows a marked tendency in the same direction, but the judgments are not completely uniform, although the exceptions involve exceedingly small quantities.[1]

A brief set of supplementary tests was made to examine the effects of changing the muscular movements when in the erect position. In one set the eyes passed around the angle from right to left, in another set the reverse procedure was adopted, and in a third the eyes were firmly fixated. The results are almost identical for all three forms.[2]

Before discussing the implications of these various results, it should be added that the experiments failed to show a parallelism between the difference threshold and the magnitude of the illusion. For *B* this threshold is expressed by 1.7 per cent. of the fixed stimulus in the erect position and 1.5 per cent. in the recumbent attitude. For *M* the figures are 1.6 per cent. in each case. The daily records show that a very small difference threshold may on any given day be accompanied by a large overestimation of the vertical, and *vice versa*.

If the illusion at issue rests *wholly* upon eye movements, it is very difficult to understand how it can be increased by merely turning the body. Surely this maneuver should be expected to reverse the direction of the illusion, or at least to diminish it in amount and render the judgments uncertain. Had the experiments resulted in a decrease of the illusion, the interpretation would necessarily have been ambiguous, but strongly suggestive of a muscular explanation for the overestimations. The relative importance of the two or more processes conceivably underlying the illusion would have remained wholly uncertain.

[1] This is at variance with Münsterberg's observations. He finds the illusion disappears or is reversed in this position. He apparently confines the validity of the illusions to point distances and short lines. (*Beiträge zur Psychologie*, Heft II, p. 175.)

[2] This also disagrees with Münsterberg's results, which he regards as confirmatory of the muscle theory. Did not the tests of this character confirm the implications of the rest of the experimentation, they would hardly be mentioned, for they were few in number. Cf. *ibid.*

If the psychological compensation theory is correct, such a turning of the head and body as practiced in the experiment might decrease the illusion by throwing the eye back upon the more immediate sensational elements present; it might conceivably leave it unchanged; or it might increase it on account of an excessive compensation of the general character so frequently encountered in attempts to cope with a new situation. Logically, then, the situation is this: a decrease of the illusion in the recumbent position would be reconcilable with either a muscular or a psychic compensation, explanation; lack of change in the illusion would also be ambiguous, but certainly less intelligible on the basis of the eye-movement theory; increase of the illusion is at least compatible with the compensation theory, but it is very doubtful if it can be reconciled with the muscle theory, at least in its usual form. Taken in connection with the tests where movement and lack of movement produced nearly identical results, and with the observed independence of the difference threshold and the magnitude of the illusion, it appears improbable that the eye muscles at present play a dominant part in producing the illusion. This is far from asserting that they contribute nothing to the situation. Just what processes are accountable for it remains frankly problematical. We have done nothing toward a real explanation when we have labeled them "compensatory." The small and constant variation tells, so far as it goes, against the emergence in the recumbent position of any factors previously inactive. We probably have to do with a change in the relations of processes operative in both positions.

A STUDY IN HABIT.

D. P. MACMILLAN, PH.D.

The present paper describes briefly a method, suggested by Professor Angell, for studying experimentally a typical habit, and records some of the observations thus far made in the employment of the method, emphasizing some of the apparent implications of these results.

The coördination of the eye-hand processes for the attainment of so simple an end as the hitting of the center of a chart, placed at a convenient distance from the body, may be regarded as involving, or depending upon, habits having relative naturalness and fixity.

By changing any one of the factors involved, say the visual processes, an opportunity will be afforded to observe the building up of a

new coördination of eye and hand under the changed conditions. This proposed alteration in the visual sensations was actually procured by arming the eyes with prismatic glasses of various powers of refraction, the eyes being used singly, thus affording greater constancy in the conditions. The result was a displacement of the visual field up or down, right or left, depending on the position of the prism, and a consequent failure in the first attempts to hit the center of the chart. The apparatus and procedure may be briefly described as follows:

The subject sat with head supported by a photographer's rest, facing a blackened wall upon which was fixed a white chart bearing dark concentric circles 1^{cm} apart. The position of the chart was so arranged as easily to permit of its being struck by a short pointer, when the arm (previously held close to the body with the hand up) moved straight forward, the distance being about 37^{cm}. The ordinary optician's frame and prisms were employed. The refractive powers of the prisms referred to in this paper were 20°, 30°, and 40° respectively.

After being seated quietly for a time, while he was becoming accustomed to the beating of a metronome, and in general at ease in the situation, the subject was asked to strike the center of the chart in time with the metronome (and that the process may be described more in detail we will take a concrete case and say) using right hand and right eye. This eye-hand coördination was, of course, to some degree new, as the monocular image did not coincide with the binocular. As soon as he struck the center of the chart ten successive times, he was requested to stop and at the same instant to close his eyes. This now represented to some degree his normal way of performing this act. A glass of 40° deflection was next inserted in the frame with the thicker edge *upward*. The subject was now told to open his eyes and immediately strike the center of the chart, which now appeared to him about 80^{mm} or 90^{mm} *below* its actual position. His first stroke revealed to him the fact that his hand did not go to the desired place. At first he became greatly agitated and interested to define the situation. Presently the end and his means of attaining it were thrown into the foreground of consciousness, and almost instantly he set to work to modify or wholly change his old way of reaching it. His endeavor was accurately to hit the center as soon as possible. As a matter of fact, however, he would strike about 70^{mm} or 80^{mm} *below* the real center the first time; the second time 60^{mm}; the third time 50^{mm}, and probably at the end of the twelfth stroke he would be able to strike the center twice in succession. He was now

told to stop and close his eyes. Account was taken of the spatial error of the first stroke and of the number of attempts before the center was struck. The glass was now removed. At the end of about eight or ten seconds (varying with the subject) he was again asked to strike the center, which he expected to appear in the same position as before the experimentation with the prism. He soon found that his hand did not move to the desired place. The newly formed habit asserted itself.[1] He found that he must change it. Again the end, the means, and the latter's experienced inadequacy came into consciousness. He struck about 25^{mm} *above* the real center the first time; the second time about 20^{mm}, and by the end of the fifth or sixth stroke he struck the center again twice in succession, when the signal was given to halt.

This cycle, then, was that which was examined. There were in all four eye-hand combinations — right hand and right eye, left hand and left eye, right hand and left eye, and left hand and right eye. The prisms were used with the thicker edge up, down, in, and out, thus deflecting the image down, up, out, and in.

The experiments, including the preliminary tests, continued from October 22, 1896, to May 6, 1897. Attempts were made to have the conditions, as far as possible, similar throughout the period of experimentation — equal times between each sitting, employment of the same hour in the day,[2] attention directed toward the same portion of the sensori-motor arc, each glass used at the same time and place in the various series, etc.

[1] On this point compare Professor Stratton's condition after wearing apparatus for eight days which inverted the ocular images. (*Psychological Review*, Vol. III, p. 611.)

[2] It was early observed that experiments made in the afternoon were much more erratic in their results than those made in the morning.

RESULTS.

TABLE I.

Subject B.—Time, 21 days. Showing decrease from sitting to sitting.

Eye-hand combination	Attention to Field of Vision					Attention to Movement			
	Prism used	Error of first attempt to strike center	Number of attempts before center is struck	Error of first stroke when glass was removed	Number of attempts before center is struck	Error of first attempt to strike center	Number of attempts before center is struck	Error of first stroke when glass is removed	Number of strokes before center is struck
		mm		mm		mm		mm	
R. H. & R. E.....	40°	84	11	24	6	54	7	19	3
L. H. & L. E.....	40	80	9	13	3	51	7	10	3
R. H. & L. E.....	40	50	5	16	3	53	8	10	2
L. H. & R. E.....	40	49	5	12	2	52	6	13	2
R. H. & R. E.....	30°	61	9	17	4	36	7	14	2
L. H. & L. E.....	30	51	9	14	2	35	6	12	2
R. H. & L. E.....	30	46	4	17	2	30	4	9	2
L. H. & R. E.....	30	68	4	11	2	39	4	10	2
R. H. & R. E.....	20°	35	7.7	11	3	22.5	3.5	11.7	1.7
L. H. & L. E.....	20	46.2	5.7	7.5	1.7	47.5	4.5	5.5	1
R. H. & L. E.....	20	19.2	3	8	1.5	20.5	3.2	0	0
L. H. & R. E.....	20	24.7	2.7	10.5	1.7	28.7	3.2	8.7	1.7
DECREASE IN ERROR AT EACH SITTING.									
R. H. & R. E.....	40°	0	0	0	0	30	3	20	1
L. H. & L. E.....	40	40	1	0	0	10	2	2	2
R. H. & L. E.....	40	30	1	18	2	45	4	15	1
L. H. & R. E.....	40	20	2	5	1	35	6	8	2
R. H. & R. E.....	30°	0	2	0	2	10	1	0	0
L. H. & L. E.....	30	20	0	0	0	20	4	10	1
R. H. & L. E.....	30	0	0	0	0	0	1	7	2
L. H. & R. E.....	30	0	0	12	3	25	2	0	0
R. H. & R. E.....	20°	5	2.7	1	3	17.5	0	0	.3
L. H. & L. E.....	20	13.8	.3	2.5	1.3	12.5	.5	0	0
R. H. & L. E.....	20	10.5	0	0	0	0	0	0	0
L. H. & R. E.....	20	0	0	0	.3	2.3	1	0	0

TABLE II.

Eye-hand combination	Subject	Number of days between first and last experiment	Order in which the experiments were given	If irregular how the time intervening was occupied	Number of days betw'n different eye-hand combinat'ns	Occupation during intervening time	Decrease of Error expressed in Terms of Percentage											
							Error of first attempt to strike the center			No. of attempts before the center was struck			Error first time after the glass was removed			No. of attempts to strike the center		
							Prisms used											
							40°	30°	20°	40°	30°	20°	40°	30°	20°	40°	30°	20°
Right hand / Right eye	B	6	In succession	.....	.....	.....	71	63	85	75	23	83	20	0	total	44	18	total
"	M	28	not "	rest	.....	.....	43	41	55	26	27	19	6	0	0	50	0	0
"	S	25	" "	sec'd gr'p experim'ts	.....	.....	75	64	78	45	87	54	94	71	total	80	71	total
Left hand / Left eye	B	6	" "	.....	6 days	exp. with L.H. R.E.	60	69	70	30	38	70	total	total	total	total	total	total
"	M	16	not "	third gr'p experim'ts	3 "	rest	74	56	89	73	54	83	"	"	83	"	"	85
"	S	6	" "	.....	0 "	.....	40	33	30	11	30	30	16	61	66	83	50	50
Left hand / Right eye	B	7	" "	.....	0 " [1]	.....	49	53	53	49	43	33	0	74	59	0	75	50
"	M	13	not "	fourth gr'p exp. given	0 "	.....	50	60	75	40	51	75	0	66	73	0	60	73
"	S	4	" "	.....	18 "	exp. with L.E. R.H.	47	40	89	15	33	25	66	0	total	50	0	total
Left eye / Right hand	B	5	" "	.....	6 "	all L.H. L.E. gr'p	0	13	35	0	48	33	total	total	total	total	total	total
"	M	7	" "	.....	0 "	.....	71	0	0	43	0	0	51	"	"	"	"	"
"	S	4	" "	.....	0 " [1]	.....	77	77	total	56	61	total	0	"	"	"	"	"

[1] Order of groups reversed.

TABLE III.

Eye-hand combination	Prism	Subject	First Time				Second Time				Third Time				Fourth Time				Fifth Time				Sixth Time			
			Error of first stroke	Number before center is hit	Error of first stroke, prism removed	Number before center is hit	Error of first stroke	Number before center is hit	Prism removed, error of first stroke	Number before center is hit	Error of first stroke	Number before center is hit	Prism removed, error of first stroke	Number before center is hit	Error of first stroke	Number before center is hit	Prism removed, error of first stroke	Number before center is hit	Error of first stroke	Number before center is hit	Prism removed, error of first stroke	Number before center is hit	Error of first stroke	Number before center is hit	Prism removed, error of first stroke	Number before center is hit
			mm		mm		mm		mm		mm		mm		mm		mm		mm		mm		mm		mm	
R. H. & R. E.	40	B	42.	4.	5.	1.	36.	3.	2.	.33	41.	2.	4.	.33	25.	2.5	0.	0.	14.	2.5	10.	1.6	12.	1.	4.	.66
" "	40	M	81.6	6.1	14.8	2.	53.6	4.3	4.	1.6	27.5	3.	9.8	1.6	25.1	2.6	9.8	.16	53.5	3.	9.	1.3	44.	3.	12.5	1.8
" "	40	S	80.	4.	15.6	2.	45.	3.4	8.	1.5	55.	4.	13.6	2.1	26.6	3.1	5.	1.	17.	2.6	total	total	20.	2.	1.	.5
L. E. & L. H.	40	B	31.5	2.3	3.3	.6	23.9	2.6	3.6	.6	22.1	2.5	1.6	.33	10.8	2.5	1.6	.3	12.3	2.	4.5	.8	12.3	1.6	total	total
" "	40	M	45.8	3.8	10.	2.	25.	3.3	13.1	2.1	36.	2.8	1.6	.33	22.	2.6	6.6	.6	14.5	2.	3.6	.6	11.1	1.	"	"
" "	40	S	83.3	4.5	12.	1.8	56.6	3.6	12.5	1.8	51.6	3.1	1.6	.33	77.1	3.6	7.3	1.	50.	4.	1.	.3	45.8	2.6	"	"
L. H. & R. E.	40	B	29.1	3.6	6.6	.1	20.6	2.6	3.3	.6	25.3	2.5	5.6	1.	19.5	1.8	6.3	1.	21.5	2.1	12.8	2.1	14.8	1.9	8.1	1.8
" "	40	M	17.5	2.5	7.3	1.3	22.8	2.8	10.1	1.6	22.	3.6	8.3	1.	21.6	1.8	6.	1.	16.6	2.	3.3	.5	8.6	1.5	7.	1.3
" "	40	S	19.1	1.8	3.3	.6	17.	2.	5.	1.	10.	1.3	3.3	.6	10.	1.5	1 1	.3								
L. E. & R. H.	40	B	25.8	2.1	total	total	25.8	2.5	total	total	23.	total	total	total	25.	3.	total	total	total	total	total	total	total	total	total	total
" "	40	M	24.5	2.3	3.3	.6	21.	2.2	6.	1.2	20.6	2.1	7.	.6	7.	1.3	1.6	.3	"	"	"	"	"	"	"	"
" "	40	S	22.	2.3	5.	.6	15.	1.8	4.	.6	12.8	1.3	5.3	1.	6.6	1.3	2.	.3	21.	2.3	5.3	.6	5.	1.	5.8	.6
R. H. & R. E.	30	B	37.	3.	7.	1.6	33.5	2.8	1.6	.33	34.1	2.5	12.	2.1	21.5	2.5	2.5	.3	16.6	1.8	11.3	2.	13.6	2.3	7.	1.3
" "	30	M	54.1	3.6	12.5	2.	30.6	4.6	4.5	.8	22.	3.6	7.8	1.3	18.	2.6	12.	2.	34.	2.8	12.4	1.6	31.6	2.6	15.8	2.1
" "	30	S	56.	6.1	15.1	2.1	44.1	3.6	14.5	2.	42.5	3.4	8.1	1.	29.	3.1	5.	1.	19.5	2.1	total	total	20.	1.6	5.3	.6
L. H. & L. E.	30	B	37.8	2.1	5.3	1.	28.6	2.5	0.	0.	17.	2.5	3.3	.6	15.	2.	0.	0.	17.	2.	0.	0.	9.	1.3	0.	0.
" "	30	M	46.6	3.5	17.	2.8	23.7	3.3	14.8	2.3	30.8	2.1	7.8	1.5	22.8	2.6	14.6	2.5	8.6	1.6	2.5	.3	11.8	1.6	0.	0.
" "	30	S	70.	4.6	19.5	3.	39.1	3.1	14.	1.8	26.	3.	6.4	1.2	43.3	3.6	9.1	1.5	46.6	3.1	7.5	1.5	21.6	1.8	3.3	.6
R. E. & L. H.	30	B	30.	2.8	7.8	1.3	20.	2.5	2.	.3	23.5	2.1	3.	.6	23.3	2.1	0.	0.	17.8	2.1	5.3	1.	14.	1.6	2.	.3
" "	30	M	25.	3.1	9.	1.6	18.6	2.1	13.1	2.	15.3	2.	5.8	1.	10.	1.5	12.3	1.6	8.6	1.5	4.1	.6	10.	1.5	3.3	.6
" "	30	S	25.	2.4	6.	.8	23.3	3.	6.6	.6	13.3	2.	0.	0.	15.	1.6	7.5	1.	0.	0.	0.	0.	0.	0.	0.	0.
L. E. & R. H.	30	B	28.3	2.6	2.	.3	24.5	2.1	0.	0.	23.	4.	0.	0.	20.	3.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
" "	30	M	23.3	2.1	8.6	1.3	10.	1.3	5.	1.	22.8	2.	0.	0.	22.8	2.1	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
" "	30	S	22.	2.1	8.6	1.	12.8	1.6	1.6	.3	12.5	1.6	5.8	1.	9.1	1.1	0.	0.	10.8	1.5	4.5	.6	5.3	.8	0.	0.
R. H. & R. E.	20	B	19.2	3.	5.5	1.2	21.2	2.5	0.	0.	15.5	1.7	8.7	1.	16.	2.	0.	0.	17.	2.	0.	0.	3.	.5	0.	0.
" "	20	M	40.	3.7	10.5	1.	15 5	3.5	3.7	0.5	10.	2.	7.5	1.7	5.	1.	9.7	1.5	18.	1.2	9.	1.5	18.	3.	1.1	2.
" "	20	S	23.	2.2	5.5	1.	22.5	3.2	0.	0.	30.	2.7	8.	1.7	11.7	2.	5.	1.	10.	2.	0.	0.	5.	1.	0.	0.
L. H. & L. E.	20	B	10.	1.5	0.	0.	12.5	1.	0.	0.	0.	0.	0.	0.	3.5	1.	0.	0.	2.5	.5	6.	0.	3.	.5	0.	0.
" "	20	M	18.5	3.	1.5	3.2	14.7	3.5	2.1	4.	14.2	2.	0.	0.	23.5	2.	14.7	2.	3.5	.5	3.	.5	2.5	.5	2.5	.5
" "	20	S	33.7	3.2	7.5	1.	25.	3.5	7.5	1.2	15.5	2.2	0.	0.	25.7	1.7	2.	.5	22.	2.2	2.5	.5	25.	2.	0.	0.
L. H. & R. E.	20	B	11.2	1.5	6.2	1.	16.2	2.	8.	1.5	15.	1.5	5.5	.7	3.	.5	0.	0.	7.5	1.	6.2	1.	7.5	1.	2.5	.5
" "	20	M	15.5	2.	9.5	1.5	4.5	.5	8.7	1.5	3.	.5	3.	.5	3.	.5	5.	1.	7.5	1.	5.5	1.	3.7	.5	2.5	.5
" "	20	S	13.7	2.	5.	.5	2.5	.5	2.5	.5	5.	1.	0.	0.	17.	1.5	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
L. E. & R. H.	20	B	8.5	1.5	3.	.5	5.5	1	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
" "	20	M	5.5	1.	3.	1.	5.	1.	2.5	.5	10.	1.5	2.5	.5	5.5	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
" "	20	S	8.7	1.5	2.5	.5	7.5	1.5	0.	0.	8.	1.5	0.	0.	11.7	1.7	0.	0.	9.	1.5	0.	0.	0.	0.	0.	0.

The experimentation was divided into two series. The first was simpler, i. e., fewer eye-hand combinations, longer time between each sitting, the same prisms used, and the image deflected by the prism in the same direction. Three subjects only, *B*, *M*, *S*, were given these primary tests, and where they are shown in Table I the results of *B* alone are presented, those of *M* and *S* practically agreeing.

The second series was given to eight subjects, although the results of the three, *B*, *M*, and *S* only, are given in Tables II and III, those of the remaining five showing the same tendencies. In one-half of the two series attention was directed to the movement — the "feel" in the knuckles, wrist, arm, etc., the "resident" images furnishing the cue; in the other half, attention was more directed to the field of vision — the "look" of the chart — the more or less "remote" images here providing the guiding sensations.

Each test naturally divides itself into two parts, which we may name the forming of the habit, and the formed habit — or the building up of a new habit and the breaking down, involved in the effort to throw off the new and resume the old. Each of these parts in turn shows two columns, the first representing the spatial error of the first stroke, the second showing the number of attempts made before the center is struck, or the time necessary again to set up accurate coördination. In Table I each number in a line is the average of eight tests, and disregards the different directions in which the images were deflected, the greater or less refracting power, as the case might be, of the immediately preceding prism, the exact place in the total series, etc. The growth of habit is indicated in Table I by comparing the averages of results obtained at the beginning with those further along the series. As, for instance, by comparing the results and by observing the increased facility when the prism 40° was used. This may be seen in the decrease in spatial error — 84^{mm}, 80^{mm}, 50^{mm}, 49^{mm}, or in the time column — 11, 9, 5, 5. Further, in Table I the decrease in errors at each sitting is observed. The disparity in results, when attention was differently directed, must speak for itself, as space will not permit of its further consideration here. It may be noted that the motor side had the advantage of succeeding the sensory side about as often as the converse, and in general shows at the outset smaller errors and prompter adjustment, as Professor James' account of resident images of movement would require.

In Table II the results of *B*, *M*, and *S*. in the second series are given, and the decrease is expressed in percentage terms, "o" marking no decrease or even gain, and "total" showing absolute recovery.

In this table efforts were made to note the relations between succeeding tests; the order in which they were given; the influence of one eye-hand coördination group on another; the connection of each test with the absolute decrease in error, as well as its relative constancy.

In Table III the results from sitting to sitting are given more in detail. The average of results secured with any particular prism leaves out of account the different directions in which it was given, the previous prisms used, and the experiments intervening between two tests with the same glass. In short, the magnitude of the deflection of the image is the only relatively constant factor.

In Tables II and III the decrease was relatively greatest with prism 20° with the three subjects, and this more uniformly in the first column.

Again, during the last days the decrease was much more significant and showed a greater tendency to vary from the somewhat regular order in reduction. It was also observed that the decrease was greater or less according as the original error was more or less significant. Further, in the few cases where the error was increased (included in those marked o in the tables) this can be traced almost uniformly to the immediately preceding prism. It may be mentioned that the amount of the error spatially considered is much less significant than the number of the attempts necessary to success. The size of the error of the first stroke will be found to vary considerably, whereas the number of unsuccessful strokes rapidly becomes small and constant. The first stroke seems often to serve to complete the orientation represented by the optical impressions. The second attempt is then not simply a reaction to a visual stimulus, but to a visual stimulus modified or reinforced by kinæsthetic impressions just experienced.

It may be noted that the relative constancy in the decrease in errors with the decrease in degree of the deflecting prisms would have a leaning toward an interpretation of Weber's law as a concrete formulation of habit or a group of habits.

Anent the difference in results when attention was directed to field of vision or to movement, it was observed, whichever factor in the sensori-motor coördination tended to be emphasized at first, that, as experimentation continued, not only was there a great reduction in absolute errors both as to space and time of recovery, but there was a marked

tendency for the errors to become equalized. This will be suggestive when compared with a similar fact observable in the so-called "types" in reaction-time experiments.[1]

A certain periodicity in the acquirement of the new coördinations was a conspicuous feature of the experiments. The sittings varied from forty-five to seventy-five minutes, of which time the first portion, varying from a third to a fifth, was marked by distinctly chaotic reactions. Then came a period, generally somewhat less in extent, of very rapid attainment of adjustments. The rest of the sitting showed a slow, gradual improvement, with occasional reversions at the end of the period ascribable to fatigue. This peculiarity must be more carefully investigated before attempting a definite quantitative statement. Taken with another fact, i. e., that those coördinations which are most difficult to achieve show the most persistent after-effects, one is inevitably reminded of the observations made by Ebbinghaus and others upon the memory processes. There is, of course, a degree of similarity in the problems presented to the organism in the two kinds of experiments, and the results certainly suggest a definite degree of similarity in the mode of responding to the demands. That there is also a periodicity in the general susceptibility to the adoption of new habits seems highly probable. The point requires separate investigation extending over considerable periods of time.

In general one may say, then, that, by changing the eye factor in the eye-hand coördination, it may be seen that there comes first a break, owing to the changed conditions; that there is a demand set up; that there is a recognition of this demand and of the inadequacy of the old form of movement to meet it; that pronounced affective and emotional elements emerge under such conditions; that a numerical statement can be given of the facility with which one uses a new movement in order to make it "fit into" the life process; finally, that these facts may be considered as having some significance with reference to the general facts of reaction and attention. With reference to *a* habit one may make the general observation that the break between the end and the capacity to meet it coming into consciousness furnishes the immediate stimulus for the reconstruction of one's way of meeting the end, i. e., for setting up a habit. This means that the *stimulus* for the formation of a habit comes from the propulsive tendency of the psychophysical organism; and that the *control* of habit in its formation and use comes from the end set up.

[1] Cf. article on "Habit and Attention," in this volume.

A STUDY OF THE RELATIONS BETWEEN CERTAIN ORGANIC PROCESSES AND CONSCIOUSNESS.

BY PROFESSOR JAMES ROWLAND ANGELL AND HELEN BRADFORD THOMPSON.

I. Introductory.

Circulation and respiration are the organic processes with which this paper is mainly concerned. An inspection of the literature dealing with the relation of these processes to consciousness reveals a condition of disagreement among investigators, both as regards fact and theory. On the side of fact the discrepancies are gradually giving way before more accurate methods of observation and experiment. On the side of theory, however, the progress toward agreement is, perhaps, less noticeable.

The thesis which we shall defend in the following pages is based primarily upon experiments undertaken by us some two years ago with the purpose of determining whether changes in the character of attention were accompanied by any regular alterations in the organic processes above mentioned. The formulation we have reached should, however, if true, be equally applicable to the observations of other investigators. This we believe to be the case, although the description of these observations is often too meager on the psychological side to permit a satisfactory comparison with our own work. Within the bounds of its pretensions our formula, if correct, will have the value of a centralizing, harmonizing principle for a mass of facts which, from many points of view, appear self-contradictory and unintelligible.

At the risk of devoting a disproportionate part of our space to the matter, we shall begin by attempting a sketch of the more important of the relevant facts hitherto observed. So far

as we are aware, these have never been brought together in the form we adopt, and they furnish the best possible proof of the necessity for some general connective principle.

II. Historical Outline.

It will be convenient to state first the factors in the processes under consideration which have been thus far differentiated.[1]

The most striking alterations shown by the respiration consist in changes of rate and depth, or amplitude. The general type of the breathing also displays certain differences under varying conditions. Thus breathing in which costal or thoracic movements predominate may take on a more abdominal or diaphragmatic character. In addition to these changes, however, must be mentioned alterations in the general rhythm and in the duration of the various constituent factors in the total respiratory act. Thus the slight pause which follows expiration may be exaggerated or may practically disappear. Similarly the pause concluding inspiration may be altered in its relation to the total act.[2] Again, as accompaniments of such changes, we may find the usual relation between the phase of inspiration and that of expiration altered; the normal relation being that of a slight excess of expiration over inspiration.[3]

The more important aspects of the circulation, to which reference is made in this connection, may be summarized as follows: (1) The rate and force of the heart-beat. (2) The tension in the walls of the blood vessels—constriction or dilation. (3) The blood-pressure. (4) The amount of blood sent

[1] Excellent descriptions and illustrations of apparatus employed in such investigations will be found in 'La Fatigue Intellectuelle,' Binet and Henri, Paris, 1897. The technique of such apparatus has been carefully studied by Hürthle, Pflüger's Archiv, 53; also by Binet and Courtier, *L'Année Psychologique*, 1895. Cf. also Langendorf, *Physiologische Graphik*.

[2] Certain authorities question the genuineness of these pauses and regard the second as distinctly abnormal. Cf. Landois and Stirling, Physiology, p. 200.

[3] The amount of air breathed under various conditions, the amount of oxygen used and the amount of carbon dioxide exhaled have all been studied with much care, but we shall make no reference to these features, as the results attained do not appear to bear in any essentials upon the considerations with which we are here immediately concerned. See Speck, Physiologie des Menschlichen Athmens, Leipzig, 1892.

to the brain. (5) The amount of blood sent to the viscera.[1] (6) The amount sent to the periphery. (7) The interrelations between (4), (5) and (6). (8) The features of the cardiac, arterial or capillary pulse: its height or amplitude, shape, etc., with special reference to its anacrotic or catacrotic characteristics. It will of course be understood that in this analysis of salient features in the circulatory process, no implication of complete independence of the elements so distinguished is for an instant contemplated. As a matter of fact, some of the processes do at times vary irrespective of the action of others, but these interrelations will be canvassed more closely later on.[2]

We may summarize the results of the various investigations as follows: The dominant tendency of sensations of every kind is, according to the latest and most careful observations, to produce a vaso-constriction in the periphery and an afflux of blood to the brain. The amount and regularity of these alterations probably depend on the intensity and duration of the stimulus. Those investigators who find regular differences in the organic processes as accompaniments of the algedonic tone of the sensation, would necessarily make an exception in favor of such sensations as are distinctly agreeable and productive in their experiences of peripheral dilations. The effects of sensation upon the heart-beat, the form of the pulse curve and the respiration vary too widely with varying conditions to permit any generalized statement. But wherever a sensation breaks in upon a state of relative quiet and repose, so that a mild emotion or shock is produced, it generally produces acceleration of heart-beat and respiration, the latter being a trifle spasmodic and often deeper.

Mental activity of the type illustrated by application to mathematical computation, memorizing or recalling past experiences is, when contrasted with conditions of greater repose, accompanied by afflux of blood to the brain. Under the conditions of the ordinary laboratory experiment, such psychological pro-

[1] Points (5) and (7) concern processes too inadequately investigated to permit very definite formulations.

[2] As in the case of the respiration and for similar reasons, we make no reference to the observations upon the chemical changes attendant on alterations in these various phases of the circulation. Cf. Hermann's Handbuch der Physiologie.

cesses are sometimes productive of peripheral constrictions and sometimes show peripheral dilations. Their effects upon the form of the pulse curve are equally equivocal, but they result with greater regularity in increasing the rate of both heart-beat and respiration, the latter as a rule becoming more superficial.

Emotions of every sort seem more effective than other psychological processes in producing increase of blood in the brain. Vaso-constriction seems to be by far the most frequent volume change in the periphery, although a modification, similar to that mentioned under the head of sensation, has to be made in favor of those investigators who find opposite physiological expressions for agreeable and disagreeable experiences. The same restriction has to be placed on the statement that acceleration of heart and respiration and increased depth of the latter are accompaniments of all emotions. It is not possible at present to speak definitely of the changes in the form of the pulse curve.[1]

Without injustice to earlier investigators, it may be said that our serious knowledge of the connections between consciousness and the organic processes with which we are here concerned, begins with the classic and revolutionary observations, both clinical and experimental, of the great Italian physiologist, Angelo Mosso.

The results of his investigations may be briefly summarized as follows, bearing in mind that the psychological conditions involved are those of sensation, emotion and application to mental calculations. We may notice first the facts concerning changes in volume:

Psychic activity of every kind produces an increased flow of blood to the brain and a decreased flow to the periphery.[2] The changes which follow emotional excitements are much more marked than any produced by intellective processes, and the responses to emotional stimuli are more noticeable in the brain than in the periphery.[3] Sleep is accompanied by a withdrawal of blood from the brain.[4] Deep in-

[1] We shall occupy the remainder of this section with a more detailed statement of the investigations upon which this summary is based.

[2] Die Temperatur d. Gehirns, p. 109. Cf. also Patrizi, *Riv. musicale ital.*, 1896. Some interesting exceptions to this general rule have been observed. They consist of cases in which the activity of attention distinctly antedated the circulatory change. Cf. Die Ermüdung, p. 195.

[3] Kreislauf d. Blutes im Mensch. Gehirn, p. 72 ff.

[4] Kreislauf d. Blutes im Mensch. Gehirn, p. 74 ff. Stimulations which are oo feeble to produce awakening nevertheless result in circulatory alterations of

spirations produce a decrease of blood in the brain, whereas deep expirations cause an increase. The same thing is noticed in the upper limbs, but in the lower limbs the relations are exactly reversed, a fact which apparently depends upon the inverse pressure relations of the thoracic and abdominal cavities, the walls of the one moving out as the walls of the other move in.[1] Superficial breathing produces practically no effect upon the cerebral circulation. The plethysmographic changes are not distributed simultaneously over the whole of the body. Local changes of both blood pressure and volume occur.[2] The changes in the volume of the brain generally precede the changes in the periphery and are, therefore, not to be regarded as on every occasion the mere consequences of such peripheral alterations.[3] The change in the brain is also often observed to outlast the change in the periphery. Moreover, the amount of such changes in the volume of blood in the brain is much less than the contemporary changes often occurring in the arm, for example, and of course much less, therefore, than those of both arms together.[4] Added to this is the fact that a decrease in the volume of a limb is not invariably accompanied by an equivalent increase of the brain volume.[5] The disparity is at times extreme.

Upon the much-mooted point as to whether or no the blood supply of the brain is controlled directly by mechanisms of its own, or indirectly through changes in pressure inaugurated elsewhere in the body, Mosso inclines to a positive opinion in favor of some neural process intrinsic to the brain itself, chiefly on the ground of the apparently primary and independent variations in the cerebral circulation.[6]

the brain and periphery. Several observers have confirmed these observations upon the effects of unconscious stimuli. Cf. Binet and Henri, ibid., p. 80; also Howell's Physiology of Sleep, *Jour. Experimental Med.*, 1897.

[1] Kreislauf d. Blutes, etc., p. 133. For following statements see pages 126 and 106. Cf. Marey, Circulation du Sang, for account of changes due to costal or abdominal forms of breathing.

[2] Cf. Bayliss and Starling, *Jour. of Physiology*, 1894, p. 159.

[3] Die Temperatur d. Gehirns, p. 152. Mosso's observations on changes in the blood pressure do not lend themselves readily to a generalized statement. The observations of other investigators to be mentioned later cover the ground more fully, and we therefore make no attempt to epitomize Mosso's work on this point.

[4] Mays questions the accuracy of these observations. He states, moreover, that he has only succeeded in obtaining noticeable alterations in cerebral circulation in response to emotions, other psychic processes being ineffective. Virchow's Archiv, 1882.

[5] Die Temperatur d. Gehirns, p. 147.

[6] The researches of Roy and Sherrington point to the direct effects, mechanical or chemical, of the metabolisms of the brain as sources, on some occa-

This is a convenient place to mention Mosso's striking view, confirmed in part by other observers, that the cerebral circulation is after all not the matter of primary import in determining the phenomena of psychic activities. It might naturally be expected that if mere increase of blood to the brain were the essential precondition of intense psychoses, any medium which would produce such increase of blood would be followed by increased mental activity. This is not always the case; witness the effects of amyl nitrite. The activity of the attention and of consciousness in general is rather to be connected with the functioning of certain nerves, which control those activities of the brain cells that are accompanied by psychic events. The appropriate analogy is that of the glands. Just as we find in these organs that mere afflux of blood is insufficient, aside from the action of certain nerves, to produce inception of their secretory functions, so the brain cells require blood for the exercise of their peculiar activities, but the mere presence of blood is not alone an adequate stimulus to such functioning.[1]

Turning now to Mosso's observations on the pulse and the heart-beat, we find the following general principles. With the exception of the rhythm and the height, or amplitude, the peculiarities of the pulse curve are entirely independent of the heart and find their explanation in the changing conditions of the various blood vessels concerned.[2] The relations between the energy and frequency of the heart-beat are not as yet definitely formulated. The heart-beat is ordinarily slower during sleep than at other times. The pulse becomes anacrotic (Fig. 1, A, after Mosso) after physical exercise, after heating the vessels and after the inception of complete physical and mental quiet; also as the result of hunger. On the other hand, intellectual activity is accompanied by a catacrotic pulse (Fig. 1, B), which is also the form observed after a meal. The anacrotic pulse is not peculiar to the

sions at least, of circulatory control. *Journal of Physiology*, XI., p. 85. Cf. also Wertheimer, *Archives de Physiologie*, 1893, p. 297. Gley has shown that in mental activity the flow of blood to the brain is, as Mosso thought, due to other causes than the heart. Étude expérimentale sur l'état du pouls, etc. Paris, 1881.

[1] Die Ermüdung, p. 195 ff. Moreover, it does not appear that the brain acts more promptly or more accurately (within the limits of ordinary non-pathological changes of volume) when it is flushed with blood. Patrizi has found the reaction time at the height of undulations in volume very slightly better than that at the lowest point of such oscillations. Cf. Patrizi, *Archiv d. Psichiatria*, 1896.

[2] Kreislauf d. Blutes, p. 49.

brain, but is found under certain conditions in other parts of the body.[1] The changes in the form of the brain pulse are noticeable only when vigorous mental activity is contrasted with complete rest. Intense intellective processes are accompanied by increased force of the heart-beat, probably because of the contraction of peripheral vessels necessitating a greater power to propel the blood through them.[2] Changes in the heart-beat are not always results of changes in the respiration, for they occur independently of such changes.[3]

Apart from the changes already mentioned in connection with the circulation, Mosso's statements about the respiratory accompaniments of psychic processes are somewhat unsatisfactory. In his book on fatigue he says, that observations upon himself show that revery is accompanied by faster breathing than voluntarily directed trains of thought.[4] When one does not attend closely, the diaphragm tends to become quiet and the thorax makes larger but irregular movements. In sleep the diaphragm is probably passive, but periodic changes occur under the effects of drowsiness. In an earlier work, however, he says it is impossible to make any satisfactory classification of breathing types as connected with mental activity, and some of his diagrams certainly conform but poorly to his formulation above quoted.[5]

M. Féré, in his treatise on sensation and movement, gives the first definite statement of antithetical physiological processes as the accompaniments of agreeable and disagreeable experiences respectively.[6] He differs from Mosso in finding certain sensory stimulations of emotional tone, which cause dilations of the peripheral vessels, instead of contractions. As is well known, he connects agreeable experiences of vari-

[1] These statements may be verified by reference to Kreislauf d. Blutes, etc., pp. 52–58, 114.

[2] Die Ermüdung, p. 184.

[3] Die Temperatur d. Gehirns, p. 150. There are, however, certain well-recognized changes in the heart-beat, as well as in the blood pressure and volume, which are due to respiration. The beats corresponding to inspiration are somewhat quicker than the others, and the amplitude of the pulse seems somewhat smaller. Binet and Henri (ibid., p. 50) have called attention to similar rhythmic changes occurring at intervals of three or four respiratory movements.

[4] Die Ermüdung, p. 182 ff. The description of the conditions under which these observations were made is too inadequate to permit satisfactory comparison with the work of other investigators.

[5] Cf. Kreislauf d. Blutes, etc., p. 70 ff. The irregularities in the breathing which he meets with in mental calculations are probably due to the distinctly abnormal conditions of his subjects.

[6] Sensation et Mouvement, Paris, 1887. He uses the words 'exciting' and 'depressing' instead of agreeable and disagreeable, but his meaning seems to be essentially as indicated.

ous kinds with such dilations of the peripheral blood vessels and with heightened tone of the voluntary muscles. Disagreeable experiences he finds accompanied by the opposite conditions of peripheral constriction and lowered muscular tone.[1] He finds momentary intellectual activity accompanied by momentary increase of power in the voluntary muscles.[2] His monograph is too inadequate in its statement of details to warrant critical comparison with the more complete investigations now at hand. It has distinct historical importance, however, because its statements, like those of the next author we shall mention, have been somewhat dogmatically incorporated in recent psychological treatises.

A. Lehmann, in his scholarly treatment of feeling, reports with much fullness his observations on the physiological accompaniments of agreeable and disagreeable experiences.[3] These agree essentially with those of Féré, but emphasize the following facts.[4] Pleasurable experiences are probably accompanied by increased amplitude of heart movements, disagreeable experiences by decreased amplitude of these movements and ordinarily by dilation of the deep-lying blood vessels. He also emphasizes more explicitly than Féré the deeper and more superficial phases of the breathing which he finds characterizing the two antitheses of feeling.[5]

Probably the most careful, systematic and important experiments, after those of Mosso, are those conducted by Binet in conjunction with Henri, Courtier and Vaschide. However much one may take issue with their usually conservative generalizations—and this is certainly the least convincing part of their work—one cannot abstain from the expression of admiration for the shrewd ingenuity and foresight with which they have executed their tasks.[6]

[1] Cf. ibid., p. 110 ff. and p. 7.

[2] The experiments of Patrizi (quoted by Binet et Henri, loc. cit., p. 194) showed that mental work carried on for an hour weakened the power of the voluntary muscles, unless there was some emotional excitement involved, in which case increased power was observed. In the last case, however, after a time the muscular strength fell below the normal.

[3] Hauptgesetze d. Mensch. Gefühlslebens, translated by Bendixen, Leipzig, 1892.

[4] Ibid., p. 82 ff.

[5] Lehmann's results, which were obtained by experiments upon five persons, certainly require confirmation. Like Féré's, they differ in the manner pointed out above from the results of Mosso, and they are distinctly at variance with many results obtained by recent investigators, not to mention our own.

[6] It will be convenient to refer in connection with these authors to a certain amount of the recent monograph literature, much of which is canvassed by them.

They find that vaso-constriction of the peripheral blood vessels is the usual result of psychic activity of any sort, especially when this follows relatively greater quiet.[1] There does not seem to be any constant and demonstrable relation between agreeable and disagreeable experiences on the psychic side and vaso-dilation and constriction on the physiological side. Pain has been observed to cause a dilation under certain peculiar conditions, and moderate pleasure has on several occasions been accompanied by constrictions.[2] The true psychic opposites from this point of view seem to be repose and activity with varying degrees of physiological excitation as their counterparts.[3] When attention is vigorously fixed on a calculation, for example, there is sometimes a dilation, whose nature is not known, and sometimes a constriction of greater or less duration.[4]

[1] This agrees with Mosso. See above.

[2] Binet et Courtier, *L'Année Psychologique*, 1897, p. 87 ff., also p. 126; Binet et Henri, ibid., p. 92.

Cf. also Patrizi, ibid. *Rivista di Freniatria*, etc., 1897. We know these articles only from reports.

Shields finds vaso-constriction of periphery with both agreeable and disagreeable odors—*Journal of Experimental Medicine*, 1896.

Dumas, *Revue Philosophique*, 1896, also 1897. Dumas' investigations with morbid and insane cases confirm in general the antithetical relations formulated by Lehmann and others regarding joy and sadness and the physiological expressions of dilation, constriction, etc.; adding some interesting observations on the changing number of blood corpuscles under these conditions. He meets curious exceptions, however.

Sewall and Sanford, studying changes of volume in the forearm under various forms of electrical, mechanical and thermal stimulation, found that strong stimulations generally produced constriction, whereas weak stimulations gave slight dilations after transitory constrictions—*Journal of Physiology*, XI., p. 179 ff.

[3] The very interesting experiments of Howell on sleep, already referred to, furnish beautiful supplements to Mosso's observations, and show that in normal sleep there is first a rapid decrease of blood in the brain, owing to fall in arterial pressure (chiefly in the periphery, it appears) with flooding of the peripheral vessels. This is followed by a period of relative quiet, and then the pressure gradually rises, the peripheral vessels undergo constriction and finally awakening occurs. He regards the fatigue of the vaso-motor mechanism as the immediate cause of sleep. He is inclined to disagree with Mosso concerning an independent vaso-motor mechanism of the brain.

[4] MacDougall, in his article on the Physical Characteristics of Attention (PSYCHOL. REVIEW, 3–158), practically agrees with the French observers, of whom we are writing, as regards the volume changes here referred to. Under the head of 'pulse and volume changes' appearing when attention is focussed on a continuous sensory stimulus, he omits any definite reference to the second part of his paragraph title, so we cannot record his results. With what he calls

Short, intense mental application—*e. g.*, the solution of a mathematical problem extending over three or four minutes—almost invariably increases the rate of the heart-beat.[1] After the cessation of the work, this acceleration may continue, or there may be a reaction toward a rate slower than the original one. The effects of long mental effort are less well known, but there seems to be an increased tendency toward slowing of the heart-beat, when compared with the natural tendency to retardation during the later hours of the day and in general under increasing fatigue.[2] Emotions of every kind, practically without exception, produce increase in the rate of the heart-beat. A few rare cases of pain and sadness have been observed to produce a gentle slowing of the rate. In general the changes observed, not only on the heart, but also on the other organic processes under consideration, show much more dependence upon the intensity of the emotion or affective condition than upon the quality as agreeable or disagreeable.[3]

'perceptual attention' he obtains first constrictions and then periodic fluctuations of dilations and constrictions. These undulations appear under several of the conditions he has studied, *e. g.*, attention to calculations, recalling of past experiences, and continued sense impressions.

[1] This has been noticed by a number of investigators, Cf. La Fatigue Intellectuelle, p. 41 ff. Mentz (*Phil. Studien*, XI., p. 567 ff.) reports a quickening of the pulse which seems closely related in its rate to the difficulty of the task undertaken.

Moderate physical exercise generally increases the rate and force of the heart-beat, but where excessive a contrary effect may be produced. The changes under physical exercise are, perhaps, due more immediately to alterations of blood pressure, which Marey has shown may by merely mechanical means affect the rate of the heart. In mental activity the pressure seems to rise, and as this alone should, on the grounds of merely mechanical explanations, decrease the rate, it is probable we have here a direct nervous control. Cf. La Fatigue Intell., p. 37 ff. and 58. Mentz finds (Cf. ibid., pp. 83, 95, 101) that auditory stimuli, whether noises or tones, produce at first slowing of the pulse and then a gradual quickening. Changes in intensity show the same result, the quickening beginning at the point where the stimulus becomes disagreeable. With involuntary attention acoustic stimuli were found to produce slowing, with voluntary attention quickening of the pulse. MacDougall (ibid., pp. 163, 169) obtained, with voluntary perceptual attention, increase of heart rate, with continuous sensory stimuli (tracing of figures on the face) slowing. The cases of retardation in the heart-beat reported by both these investigators seem to lend themselves with difficulty to harmonious incorporation in the observations and hypotheses of Binet and his fellow workers. They agree with our own observations, however.

[2] The capillary pulse may almost disappear under these conditions. It has been suggested that this is due to increased pressure. If true, this fact would seem to present a rather troublesome anomaly for Howell's interesting theory of sleep, elsewhere referred to. Cf. Binet et Henri, *loc. cit.*, p. 96 ff.

[3] Binet et Courtier, *L'Année Psychologique*, 1897, pp. 104, 125–126.

Mental work when intense shows a tendency to alter the form of the capillary pulse curve by decreasing its amplitude and with some persons rendering its angles blunter, while the dicrotic may move upward or shrink. With others there is instead of this a distinct emphasizing of the dicrotic and no noticeable decrease in angularity.[1] Conditions of quiet and repose are ordinarily accompanied by a pulse of large amplitude with clear dicrotic. It is possible that a classification of the emotions may prove to be feasible on the basis of the changes of the pulse, but this is hypothetical.

The blood pressure probably rises under every mental excitation, whether the occasion be attention to a sensation, to a calculation or to an emotion.[2] Nor does the nature of the emotion apparently affect the fact of this rise, although it may show a difference in the degree of the latter.

The rate of respiration is increased by mental work of every kind, both the expiration and the expiratory pause being shortened, emotions producing an increased amplitude in the respiratory curve, mental calculations and the like producing more superficial breathing, with decrease of amplitude in the curve. Occasionally sadness produces a slowing of respiration.[3] The effects of emotional states are, however, relatively irregular.

[1] Gley (ibid.) finds mental work increases the amplitude of the carotid pulse and accentuates the dicrotic. Binet et Henri (ibid.), p. 98 ff., also 113 and 120 ff. Binet et Courtier (ibid.), pp. 30–65. Physical exercise of a violent type seems to lessen the amplitude of the pulse and to diminish the clearness of the dicrotic.

[2] Kiesow's observation (*Philos. Studien*, 1895) that changes in blood pressure are noticeable only in connection with affective psychic conditions is criticised on the ground of inadequate technique.

[3] Binet et Henri, ibid., p. 156 ff. Binet et Courtier, ibid., p. 65.

Delabarre (*Revue Philosophique*, Vol. XXXIII., p. 639 ff.) found that persons who naturally breathe rapidly show relatively little effect on their respiration when their attention is engaged; but persons who ordinarily breathe slowly display a distinct tendency to acceleration of respiration when exercising their attention, the acceleration seeming to bear a general relation to the measure in which the attention is exercised.

MacDougall (ibid.) found that with perceptual and sensory attention there are generally increased rapidity and superficiality of respiration. The long inspiration and short expiration of sleep and relaxed inattention give way to lengthening of the time occupied by the second factor and shortening of the time of the first. The effects on the respiratory pause are ambiguous. Calculation produces the same general changes found by the French investigators. Recall of past events, when tinged with emotional excitation, is productive of great irregularity of amplitude and form, although the increase of rate is still observed.

Like ourselves, these investigators have been relatively less interested in the effects of psychological conditions upon the voluntary muscles. Mental activity certainly affects the muscles, but the effects differ, depending on the length of time devoted to the psychic process and on the presence or absence of an emotional tone in the experience.[1]

III. Theoretical Considerations.[2]

It will be observed that the investigations which we have been reviewing deal with two separate problems. The first problem concerns the differences in circulation, respiration and muscular tone which characterize the antithetical affective conditions denominated respectively agreeable and disagreeable. The second has to do with the differences manifested by these physiological activities under the various typical psychological conditions, *e. g.*, sensation, intellection, etc., and more especially with the differences distinguishing the affective from the non-affective processes. It is unnecessary to emphasize the lack of any established general principle of correlation for the results of these various investigations, much less to dwell upon the disagreements in regard to details.

Mentz (ibid.). In general the breathing tends to follow the rate of the pulse reported above. The strong tendency of heart and respiration to change rate together and in the same direction has been noticed repeatedly. The intimate nature of the connection is unknown.

Lehmann's interesting observations (*Philos. Studien*, Vol. IX., p. 66) on the fluctuations of attention and the different phases of respiration seem to show that the moment of completed inspiration, when the volume and pressure of the blood in the brain are at a maximum, is most favorable for mental activity. Needless to say, this does not altogether agree with Patrizi's observations.

Whipple has found (*Amer. Jour. of Psychology*, 1898, p. 560) that forced respiration seems to assist muscular activities, but to interfere with psychic processes and the functions of the higher centers.

[1] Jastrow (*Amer. Jour. of Psychol.*, IV., 398; V., 223) and Tucker (*Amer. Journal of Psychol.*, VIII., 394) have studied the nature and direction of certain unconscious movements of the voluntary muscles connected with different psychological processes. Heinrich (*Zeits. für Psychol. und Physiol. d. Sinnesorgane*, IX., 342; XI., 410) and Mentz (ibid.) have found that with mental calculations the pupils dilate, the lenses become flat and the eyes assume nearly parallel axes.

[2] Logically and chronologically, Section IV. of the paper dealing with our own experiments should precede Section III, for the views defended here are based on the observations therein reported. The present order is adopted in the interests of brevity and clearness in presentation.

If we knew the precise significance in terms of organic metabolisms of such processes as constriction and dilation, we might hope to build up a theory on the basis of such knowledge. Unfortunately, this is not the case. Furthermore, we have seen that various observers have failed to note any uniform connection of these processes with pleasure and pain, in which conditions the 'vitality' theories would find the reflection of organic weal and woe. We find ourselves thrown back then upon some general view of the organism as a whole, if we desire a principle of interpretation for the phenomena concerned.

Such a view is offered us by the ordinary evolutionary doctrine, which finds the essential problem of the organism in the adapting of itself to an environment. This adaptation must involve on its physiological side metabolisms of various kinds, in which katabolisms and anabolisms must sustain certain fairly definite relations of dynamic equilibrium, provided the life process is to be subserved.

If we make reference to any one region or to any one process, the exact relations of these antithetic metabolisms must be constantly changing. Slight excesses of wastage at one point and one period will be offset by repair at a later period. The variations from equilibrium must in conditions of health be relatively insignificant, in order to permit of elastic response to the demands of the total environment. Moreover, these adaptive processes must be constantly in progress and must accompany the psychological conditions called intellective quite as truly as those called affective. Having regard, therefore, to the very various circumstances in which the organism is called upon to respond to changing stimulations, it seems at least possible that the regularity with which these metabolic processes progress, rather than the presence or absence of any one feature in the process, should be the most characteristic expression of the total organic condition. Certainly the presumption that a psychological process like pleasure in its multiform phases should, regardless of its concomitant mental conditions, be accompanied invariably by a single physiological process like dilation, implies a simplicity of structure and function in the psycho-physical organism and a constancy of organic and environmental conditions which probably do not exist.

In view of such considerations our experimental observations lead us to believe that the changes in circulation and respiration which accompany alterations of consciousness can be formulated in terms of attention as follows:

When the attentive process runs smoothly and uninterruptedly, these bodily activities progress with rhythmic regularity.[1] Relatively tense, strained attention is generally characterized by more vigorous bodily accompaniments than is low-level, gentle and relatively relaxed attention (of drowsiness, for instance); but both agree, so long as their progress is free and unimpeded, in relative regularity of bodily functions. Breaks, shocks and mal-coördinations of attention are accompanied by sudden, spasmodic changes and irregularities in bodily processes, the amount and violence of such changes being roughly proportional to the intensity of the experience.[2]

In order to make clear the application of this hypothesis to the facts at issue, we must analyze briefly the mental conditions concerned with reference to the attention. We shall need to consider the following: (1) Emotions of various kinds. (2) Sensations both feeble and intense, both expected and unexpected, both transitory and continuous, both agreeable and disagreeable. (3) Intellective processes involving memorizing, recalling and reasoning in the narrow sense, *e. g.*, mathematical calculations; also revery.

Now, emotions represent psychological conditions of great instability. Especially is this true when the emotion is profound. The necessity is suddenly thrown upon the organism of react-

[1] To prevent tedious repetition we shall hereafter, except when otherwise stated, use the phrases 'bodily activities,' 'bodily processes,' 'functions,' etc., to mean respiration and circulation.

[2] It will be remembered that the fundamental antithesis found by Binet and his co-workers is that of mental activity in general as against mental passivity. In apparently abandoning any one physiological change like vaso-constriction or increased rate of respiration as a criterion of the psychological condition, we do not mean to imply, even tacitly, that no single change of such character is an essentially constant companion of any one psychological process, like the emotion of anger, for instance. We simply emphasize the apparent absence of any such change as an invariable index of more than one or two conditions, whereas the changes as we formulate them appear to be constant for all conditions. The experimental portion of the paper will bring this point out more fully.

ing to a situation with which it is at the moment able to cope only imperfectly, if at all. The condition is one in which normal, uninterrupted, coördinated movements are for a time checked and thrown out of gear.[1] Equally spasmodic and interrupted is the activity of attention. It may on the other hand be asserted, in opposition to this view, that never is attention so monopolized and completely absorbed by a situation as in the case of a deep emotion. But this is to overlook the cataclysmic change at the outset of the emotion, as well as the violently recurrent rhythms with which the situation is surveyed.[2] In no strict sense does the attention ever delay long with absolutely one phase of an idea,[3] and by so much as the profound emotions are more intense than the ordinary experiences of life, by so much are the shifts in attention more violent than usual.

Moreover, affective conditions of every kind show their affinity with the emotions by a similar instability of attention. This instability is far less with agreeable experiences than with disagreeable ones. This may be connected with the fact, made much of by some psychologists, that pleasure represents a tendency to persist and pain a tendency to change.[4] It calls to mind also the theories of pleasure as associated with normal and moderate activities, and pain as associated with excessive activities.[5] But whenever the experiences are very intense we meet,

[1] Cf. Dewey, 'Theory of the Emotions,' PSYCHOLOGICAL REVIEW, Vols. I. and II.

[2] It may at first sight appear that, however fairly this description applies to the more tempestuous emotions, like anger, it is seriously defective when applied to some of the semi-morbid phases of grief and depression. Waiving the justice of the criticism of this characterization of the play of attention in the depressive emotions (we think the apparent difference of opinion rests on a confusion of attention to a topic of thought with attention to a single image), we may simply reiterate, that our observations indicate that the bodily changes run parallel, as regards their regularity or irregularity, with the mode in which attention proceeds. In general the emotions show a much disturbed condition in this particular. But for us this is more or less of an accident, and our contention would be in no wise affected if emotions showed a precisely contrary condition, provided attention also changed its characteristics.

[3] Cf. James, Prin. of Psy., Vol. I., p. 421. Ribot's Psychol. of Attention presents a thoroughgoing account of attention as 'monoideism.' The effects of neural fatigue would forbid any long-continued dwelling upon literally one idea. Cf. Hylan, 'Attention,' Monograph, PSYCHOL. REVIEW, 1897.

[4] Stephen, Science of Ethics. Horwicz, Psychol. Analysen.

[5] Spencer, Prin. of Psychology.

at the moment of their initiation at least, with relative instability of attention, though the continuance of this instability is incomparably more marked with the unpleasant states than with the pleasant ones.[1] This is tantamount, of course, to saying that the whole distinction is relative.

The different conditions of attention under which sensations may be experienced vary rather more widely than those of emotions, so that if we had regard only to the fact of the presence of a sensation, we might fallaciously assume a uniformity of conditions which does not exist. What we have said of affective conditions in general, in the previous paragraph, holds equally true when these affective experiences have a sensation as their basis, and need not be repeated here.

The distinction between expected and unexpected transitory sensations is one of considerable import for our interpretation.[2] This is the more true the more powerful the sensory stimulus employed. It becomes relatively insignificant as such stimuli approach the limen. The effect of an expected sensation upon attention will, if the sensation be not so intense as to produce shock, nor so feeble as to require excessive effort to detect it, be the securing of a slight strain of anticipation, with at times a somewhat definite relaxation when the sensation is felt. On the whole the play of attention is relatively free and unimpeded. When the stimulus is so faint as to require great concentration we may get more irregularities, owing to the fluctuations of attention from fatigue, distraction, etc. But still the conditions are relatively stable. With the very intense stimulus, whether expected or not, there is sure to be something approaching shock, and with this the introduction of a distinctly disagreeable affec-

[1] Ward's formulation of pleasure and pain in terms of the effectiveness of attention has much that is allied with the view we are presenting. It does not, however, seem to do full justice to the neutral-toned consciousness of moderate intellectual labor, where attention is apparently exercised with distinct effectiveness. (Cf. Ency. Brit., article 'Psychology.')

[2] The conditions involved in expected and unexpected sensations approximate closely those of voluntary and involuntary sensory attention (cf. Mentz, ibid.). The so-called cases of involuntary sensory attention are such as occur when a stimulus succeeds in breaking in upon a condition of mental pre-occupation, whether one be engaged in intense thought processes or in some of the various forms of revery. We cover both these cases, but do not use this terminology.

tive condition, whose consequences we have already canvassed. Indeed, a sensory stimulus of very moderate intensity may, if unexpected, produce this shock in a rudimentary way, and this more violent disturbance to attention is the principal difference noticed between the expected and the unexpected sensation. With many unexpected sensations this shock may practically disappear. The process going on at the time the stimulus is given will determine in large measure its effectiveness or ineffectiveness in producing such shock.

Sensations which are continuous, provided they be not very intense, produce conditions of attention which are relatively regular and stable. We speak here of the cases in which attention is intentionally fixed on the sensations. If continued long, we shall get rather definite fluctuations of attention, but these need not be violent within any ordinary limit of time. Sooner or later we should meet total collapse of attention, preceded by the phenomena of mal-coördination that accompany fatigue. Continuous sensations, which are not made definite objects of attention, produce very various results, sometimes being relatively ineffective and at other times seeming to modify materially the attentive process. The psychological conditions involved appear too ambiguous to warrant laying much stress on these cases.[1] A series of very intense sensations, or a really continuous sensation of this kind, will produce, as in the case of the transitory sensation, distinct shock and its disturbing consequences for attention.

From the standpoint of attention the intellective processes involved in memorizing and in simple mathematical calculations have much of affinity with the continuous sensation and represent relative stability and regularity. If the task becomes too confused, as it may when one is required to multiply mentally one three-place number by another, then we may meet with breaks and irregularities in attention. Moreover, we shall often find that such experiences are accompanied by a slight feeling of anxiety and distress, springing from the interest in accom-

[1] Cf. Mentz (ibid.). The chief difficulty in these instances arises from attempting to apportion the responsibility for the changes observed between the existing mental processes, into which the continuous sensation is supposed at times to inject itself, and the sensation itself.

plishing the work promptly and correctly. Where this element enters to any degree, we may look for the characteristics of emotion. Indeed, we may properly remark in this connection that under ordinary conditions these processes, which we are analyzing separately, necessarily overlap one another at times. The mental application in the case of the intellective processes is usually to problems received from sensory sources, visual, auditory, etc. The sensations impinge upon already existing affective and intellective conditions, and emotions are, with the best of intentions on the part of the experimenters and subjects, likely to intrude themselves in some measure upon all the processes studied. When the attention is relatively strained and tense, we meet the greatest stability and regularity, if the task in hand is just difficult enough to be successfully carried forward at the rate at which new aspects of it open up. Thus we may obtain great regularity of functioning, if series of problems in addition or multiplication are presented at just that rate which permits their most rapid solution, avoiding on the one hand unoccupied leisure between the problems, and on the other hand insufficient time for completing them.

The cases in which one attempts to recall past events show considerable variations, depending on the nature of the subject-matter recalled. Verbal material which has been learned by heart may be recalled under conditions of great stability and regularity of attention. Events, on the other hand, may or may not be recalled readily, and if they do not come to mind easily we shall get more or less instability of attention, the results depending on the amount of effort put forth. Such processes are especially prone to take on emotional coloring with its tendency to instability.

Revery, in the proper sense of the word, represents frequently a high degree of free and regular play of attention, interrupted now and then by the emotional suggestiveness of the subject of thought. When revery passes over into drowsiness, the attention becomes much relaxed and functions on a low level of intensity, but yet as a rule with a considerable degree of smoothness. Individuals vary vastly, however, in the nature of the revery process.

If we turn now and arrange our psychological conditions in a hierarchy representing increasing stability of attention, we shall obtain something of this kind: (1) The profound emotions, presenting sometimes an appearance of stability, but even here distinctly of the abnormal, paralytic type. (2) The more violent affective conditions, certainly the disagreeable and painful experiences, less confidently the instances of extremely pleasurable experiences. (As has often been mentioned, it is exceedingly difficult to produce very intense pleasures under laboratory conditions.) (3) Cases of transitory and relatively superficial emotions (including cases in which emotional excitement occurs, although the conditions are ostensibly those of intellective processes, *e. g.*, recall of past events) intermingled with responses to unexpected sensory stimuli of moderate intensity and brief duration. Expected sensations, if relatively intense, also belong in this class, together with many agreeable sensory experiences. (4) Cases of continuous sensations, the regularity being greater in proportion to the effort made to attend and being, perhaps, greatest with relatively weak sensations. Mental application, as in the case of mathematical calculations, when executed under the most favorable conditions as above described. Many cases of non-emotional revery. The revery of drowsiness differs in its type of regularity from that manifested by application to a problem, in that one is accompanied by the phenomena of relaxation and the other by those of greater organic excitation. But both are relatively stable.[1]

This brings us to a consideration of our experimental material. After a brief description of the conditions under which we have worked, apparatus, etc., we shall proceed to show how radically the physiological accompaniments of apparently similar psychological conditions may vary from time to time, depending on the manner in which attention functions. It should

[1] It will be understood that this classification pretends to nothing but a rough suggestiveness of the relations these different processes bear to one another when attention is employed in this way for connecting them. It will have served its purpose if it brings out a few salient relationships, such, for example, as the community of certain sensation processes with intellective conditions and that of certain other sensation processes with emotion.

not be understood that we dogmatically deny any constancy of changes aside from the form of constancy we emphasize, although such constant conditions are rare. We simply maintain that from our observations the only feature which appears essentially constant under ALL PSYCHOLOGICAL conditions is the relative stability and instability (of the dynamic type) which these organic activities manifest in connection with the different processes of attention. We have stated this previously, but repeat it to avoid confusion and misunderstanding.

IV. REPORT OF EXPERIMENTS.

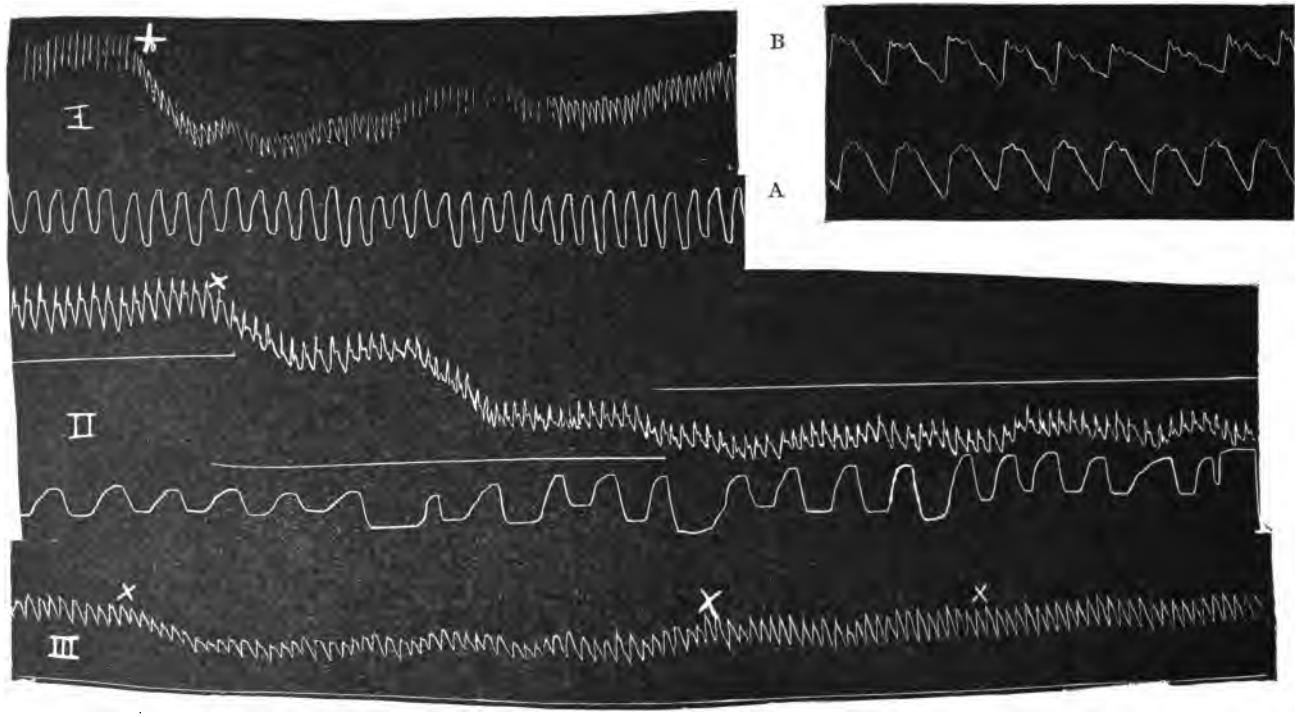
The experiments which give rise to this paper consist of two very complete series of tests taken from two different subjects. Less extended observations upon a number of other subjects have tended to confirm our confidence in the general position we adopt.

The curves showing circulatory changes are all capillary pulse tracings, taken with the air plethysmograph invented by Hallion and Comte. The air plethysmograph was adopted in preference to the water plethysmograph, cardiograph, or any of the methods of taking the arterial pulse directly, because of the greater delicacy and accuracy with which it registers slight variations in the form and amplitude of the pulse curve. The plethysmograph was connected with a Marey tambour, writing in the ordinary manner upon a smoked drum. After a somewhat extended series of experiments upon technique, the most advantageous bodily position, adjustment of the plethysmograph, quality of rubber and length of pointer for the tambour and relative position of tambour and drum were adopted and preserved throughout the experiments.[1] Careful tests upon the accuracy of the instruments have convinced us that the curves may be relied upon for recording the direction of changes in the volume of the blood in the hand, in the rate of the heart-beat, and in the form and amplitude of the capillary pulse.[2]

[1] The conditions adopted by us agree substantially with those of Binet and his co-workers. The fact that a few of our curves are to be read in a different direction from the others arises from a temporary reversal of the drum, which has no effect whatever on the curves, although we regret the lack of uniformity in their appearance.

[2] The apparatus does not record pressure changes.

PLATE I.



I., Anger; II., Emotional Excitement; III., Cross 1, Embarrassment; 2, Addition; 3, Multiplication.

EXPLANATION OF CUTS.

1. All curves read from left to right, except when arrows indicate the contrary. 2. The process illustrated by the curves begins in every case at the point indicated by a cross. 3. A fall in the pulse curve always indicates vaso-constriction, and a rise vaso-dilation. 4. The respiratory curves, when given, are always placed immediately under the pulse curves with which they belong.

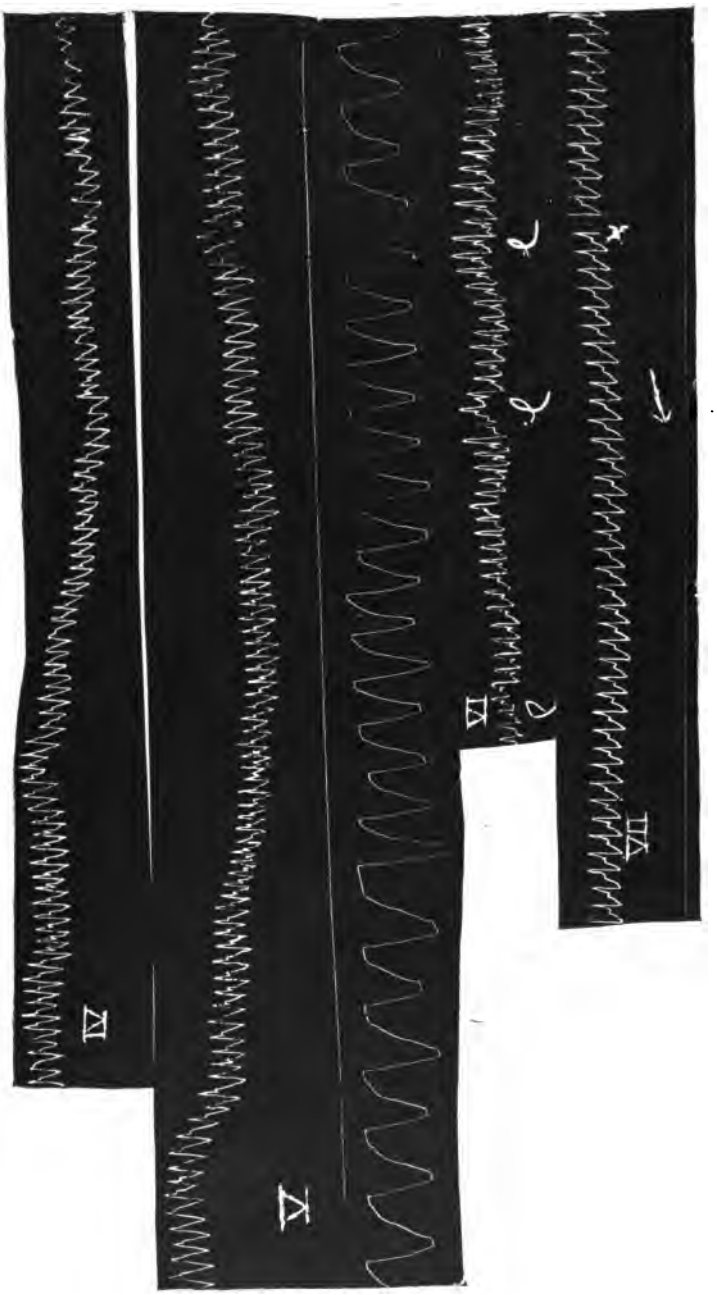
The absolute measurements of the curves of one day could not, however, be compared with those of another, since slight changes in the adjustment of the plethysmograph or of the tambour produce slight alterations in the absolute dimensions of the curves.[1] A modified form of Bert's respirator was used for recording the breathing curves.

The emotional experiences of this series of experiments were spontaneous emotions arising from the subject's own thoughts when left to himself. The most noticeable effects of emotional states upon the bodily processes are the sudden, violent changes and irregularities produced. The vaso-motor shifts are the most evident of these changes, although marked irregularities in the rate and amplitude of both breathing and pulse curves occur. In Plate I., Figs. I. and II. show characteristic cases of violent emotion; Fig. III. is an example of one of the milder emotions, embarrassment.

It is in the case of the emotions, where the agreeable and disagreeable experiences are most intense, that we should expect to find the most marked and constant correspondence of agreeable states with one set of physiological processes and of disagreeable states with an antithetical set, if any such relationship existed. But our curves show not the slightest evidence of such an interconnection. None of the various factors involved, vaso-motor level, rate and amplitude of the pulse curve, position and emphasis of the dicrotic notch, or rate and amplitude of the breathing, changes uniformly in one direction for agreeable experiences, and in the opposite direction for disagreeable experiences. No doubt cases occasionally occur where some regular connection of the kind mentioned is found. But it is occasional and not invariable, in fact probably rare. Almost all of our emotional experiences, whether agreeable or disagreeable, produced vaso-constrictions. This agrees with the observations at the Sorbonne and is what Mosso's work would lead us to expect. Figs. IV. and V. (Plate II.) are examples of an unpleasant and a pleasant anticipation respectively, experienced

[1] Binet expresses a greater confidence in the comparability of curves taken at different sittings than our experience has led us to feel. But, as the matter is largely one of skill, he is doubtless justified in his assurance.

PLATE II.



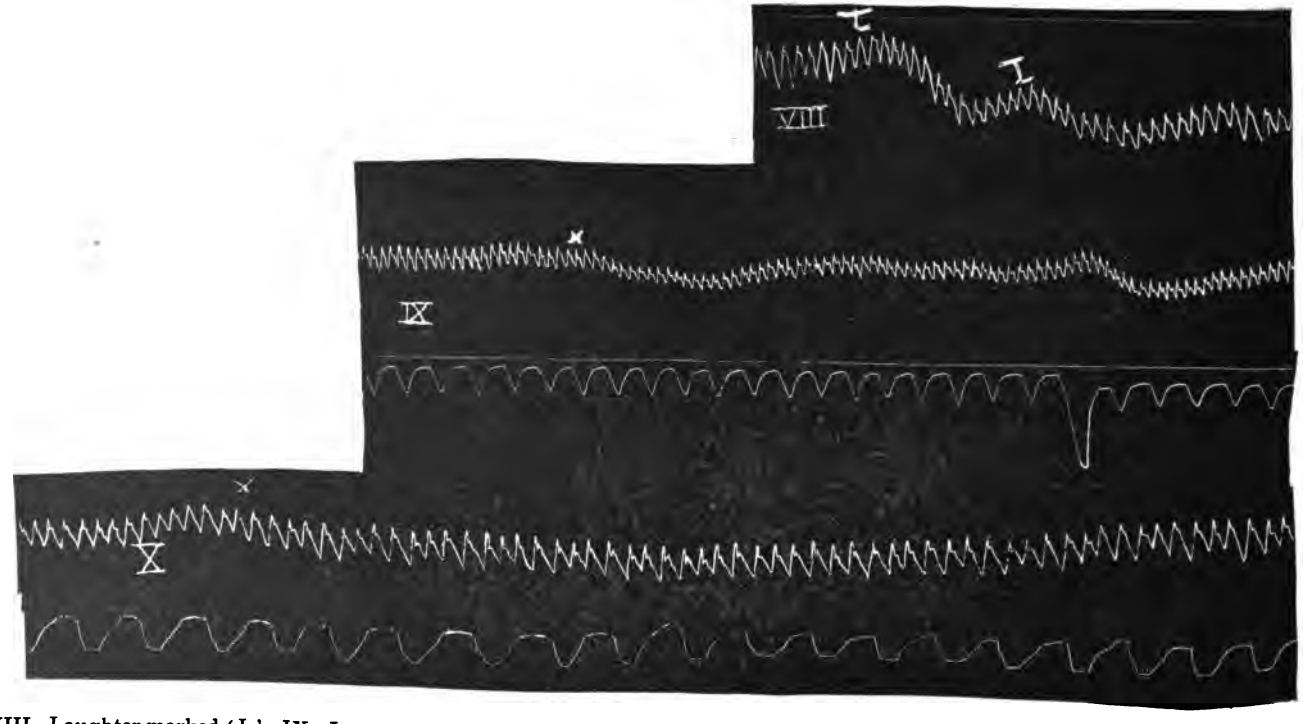
IV., Unpleasant Anticipation; V., Pleasant Anticipation; VI., Laughter at each point marked '1;' VII., Amusement.

by the same subject at one sitting. Both cause violent vaso-constrictions. The most important exception to this rule is the fact that with one of the subjects, laughter causes a slight, sudden vaso-dilation (see Fig. VI., Plate II.).

At first sight the vaso-dilations due to laughter would seem to be a confirmation of the theory that agreeable experiences are accompanied by dilations of the peripheral blood vessels. But there are several facts which take away the value of this evidence. In the first place, the vaso-motor change seems to be a secondary effect of the sudden spasmodic change in the breathing. Of course, the spasmodic breathing of laughter is an essential factor in it, and it is impossible to separate the secondary vaso-motor changes due to breathing from those accompanying the feeling of amusement in laughter. But the character of the vaso-dilations seems to run parallel with the breathing changes rather than with the feeling of amusement, which does not, as every one knows, always correspond with the heartiness of the laughter. A hearty laugh, causing sudden, violent changes in the breathing curve, is accompanied by the sharpest and most marked vaso-dilation, while a smile or mild laughter causes much slighter and more gentle changes in the vaso-motor curve. In confirmation of this view, we have one curve from this same subject, in which mere feeling of amusement, unaccompanied by any of the breathing changes of laughter, produced a slow vaso-constriction (VII., Plate II.). But more important still, as contrary evidence, is the fact that, in the case of the other subject, constriction and not dilation is the most marked vaso-motor accompaniment of laughter. VIII., Plate III., shows characteristic laughter curves for this subject. They display slight initial dilations followed by marked constrictions. In this case, too, the amount of the vaso-motor change is in general proportional to the amount of the disturbance in the breathing. But why in one subject spasmodic breathing should have vaso-dilation as its concomitant, and in another subject vaso-constriction, is a mystery. However, the facts show that the dilations of laughter in this case can not be taken as confirming the theory that vaso-dilation accompanies pleasant experiences.

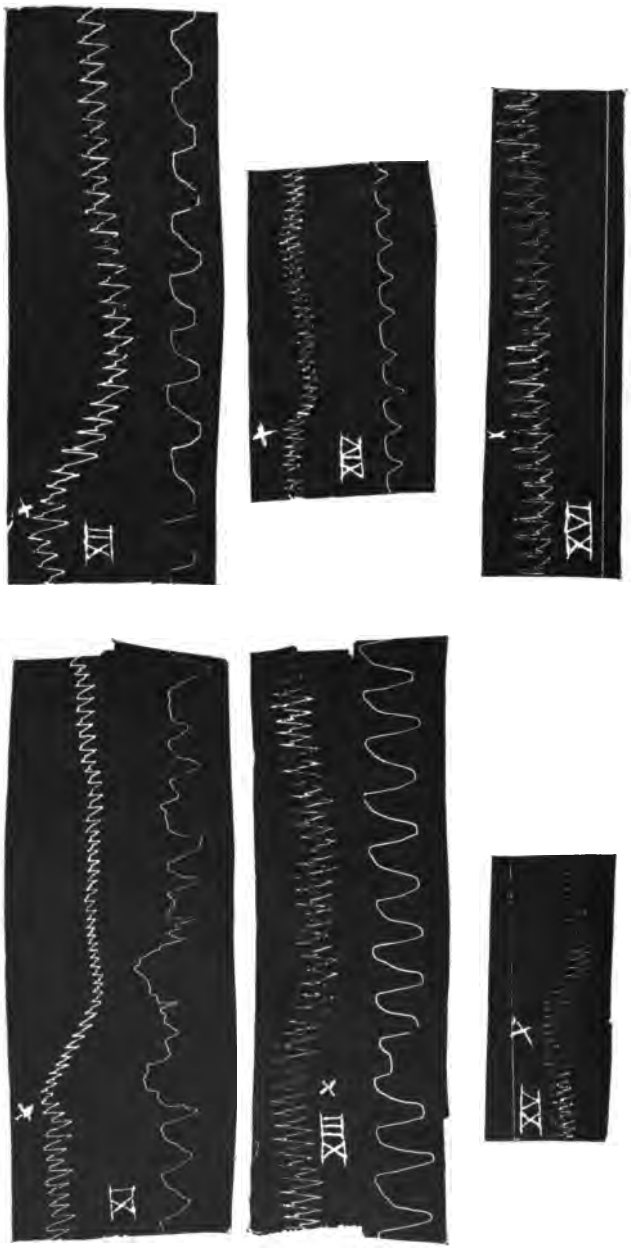
The amplitude of the pulse curve shows a greater or less

PLATE III.



VIII., Laughter marked 'L'; IX., Interest followed by Emotional Excitement at Cross; X., Apprehension, warned of impending shock.

PLATE IV.



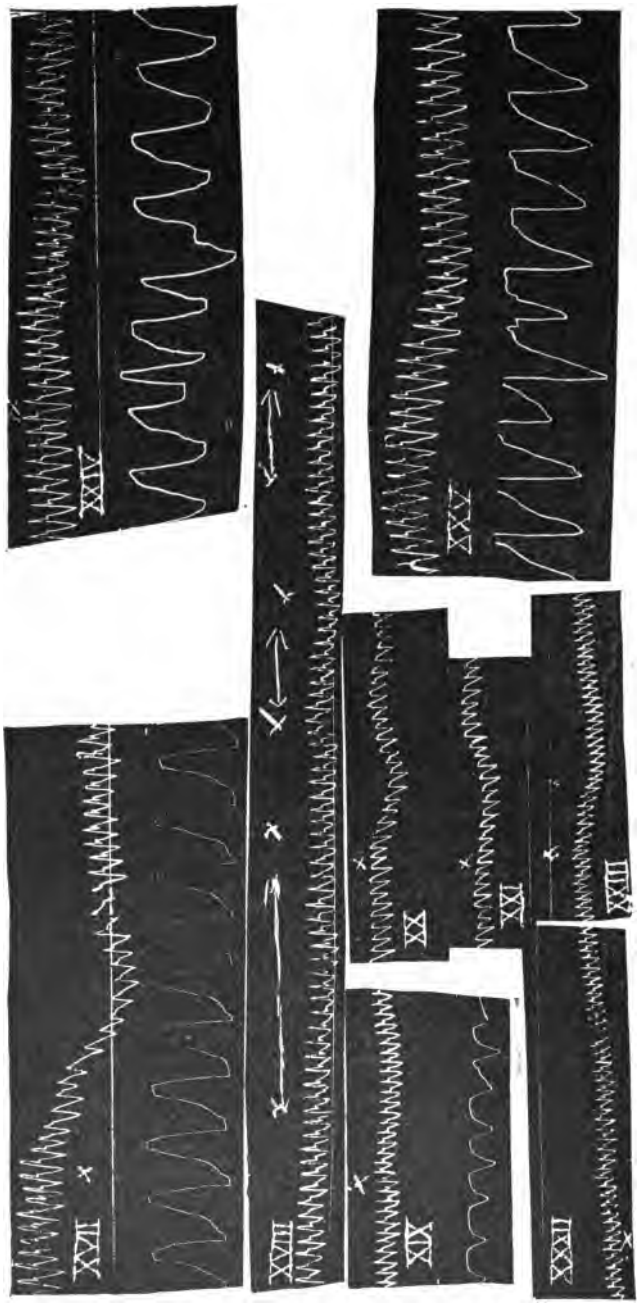
XI., Cold; XII., Noise; XIII., Camphor; XIV., Cold; XV., Noise; XVI., Camphor.

decrease for both subjects in almost all of the emotional experiences, whether agreeable or disagreeable. There were, however, a few cases of increase of amplitude. The great irregularity of amplitude during emotional experiences is a more uniform factor. (See Figs. I., II., III. and IX.) The rate of the heart-beat is sometimes increased *on an average*, sometimes decreased, and sometimes not changed at all. Increase of rate is much the most frequent occurrence regardless of the quality of the emotion, but all of these changes take place during each of the two great emotional states (compare Figs. I., rate unchanged; II., rate increased; III, rate both increased and decreased; and X., rate decreased). But whatever the average change of rate may be, a more uniform and, in our opinion, more significant feature is the spasmodic irregularities of the rate characteristic of curves corresponding to emotional states (compare Figs. I., II., III., IV., V. and X.), a feature strongly indicative of the general physiological instability of emotional states for which we are contending. The changes in form and position of the dicrotic notch[1] are as erratic as the amplitude and rate changes. The notch is sometimes raised, sometimes lowered, sometimes emphasized and sometimes flattened, with entire disregard to the affective tone of the emotion.

The breathing during emotional experiences shows no greater uniformity in direction of change than the pulse. All the variations of increase and decrease of both rate and amplitude of the breathing are found accompanying both agreeable and disagreeable experiences. In the more violent emotions (see Figs. I. and II.), and, of course, in laughter, the breathing becomes very spasmodic and irregular as to both rate and amplitude. The lesser emotions show smaller disturbances (see Figs. IV., and X.), while some of them show no change at all (see Fig.

[1] The emphasis and position of the dicrotic notch vary greatly in our different curves. This is no doubt largely due to the fact that the dicrotic notch varies so greatly at different times of the day and under different conditions of nutrition and of activity. (See Binet and Courtier, *L'Année Psychologique*, 1897, p. 10.) It may also be due in part to slight differences in the adjustment of the instruments at various sittings. But, since our conclusions are based upon immediately successive changes in the form of the curve only, this is a matter of no moment in the present case.

PLATE V.



XVII., Heat; XVIII., Color red, eyes open where arrows occur; XIX., Expected noise; XX., Slight noise; XXI., Cold; XXII., XXIII., Disagreeable odor, capsicum; XXIV., XXV., Camphor.

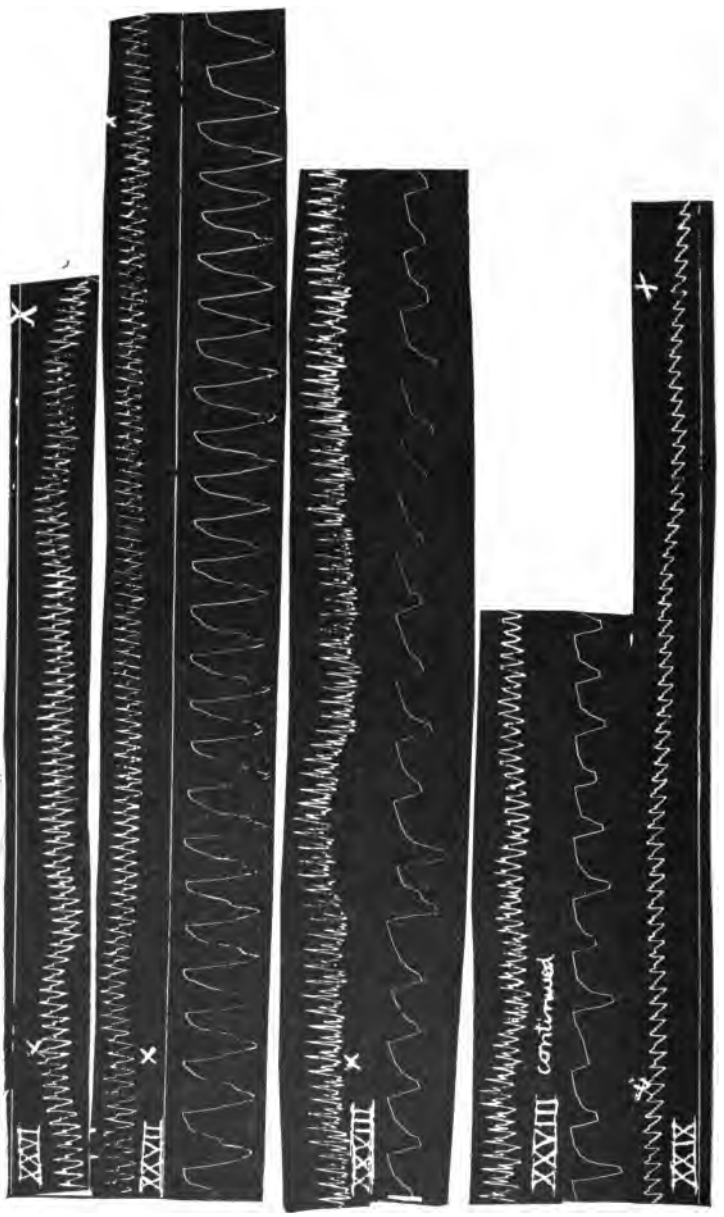
IX). The breathing, then, at least in the case of the more violent emotions, shows the same functional disturbance which has already been shown to be characteristic of the pulse curves.

According to the psychological analysis of the states known as emotion, sensation and intellectual application, which was offered in the preceding section, we found that, when classified with respect to the stability of the attentive process involved, sensation occupies a middle range between emotion and mental application. It was also pointed out that the term sensation covers a great variety of experiences, some of which border closely upon emotional states, while others approach the intellective conditions. If the hypothesis is correct, that the degree of stability of the physiological processes runs parallel with the degree of stability in the attentive process, we ought to find in general the curves for sensation showing less disturbance than those for emotional states, and more than the curves for intellectual application. Moreover, we ought to find the curves representing sensation varying from curves approaching the emotional type to those closely resembling the type of intellectual application, according to the quality of the sensation as regards the functioning of attention. This is exactly the relationship which a study of our curves reveals.

Figs. XI. to XVI., inclusive, are typical curves of sensory stimulation. The first three of the set are taken from one subject, and the last three from the other. A comparison of these curves with the preceding ones of emotional experiences and with the succeeding curves of mental application (Figs. XXVI. to XXXI.) will show that the vaso-motor shifts for sensory stimuli are not so great as those for emotional experiences, but are much greater than those in the mental application curves. The amplitude and rate are less spasmodic and irregular than those for emotional states, but not nearly so uniform and even as the rates and amplitudes of the curves of mental application. The amplitude and rate changes which occur are often equal in amount to those of emotional experiences, but they are less jerky and irregular. They approach more nearly the even, progressive changes of mental application.

But within the large class of psychic states known as sensa-

PLATE VI.

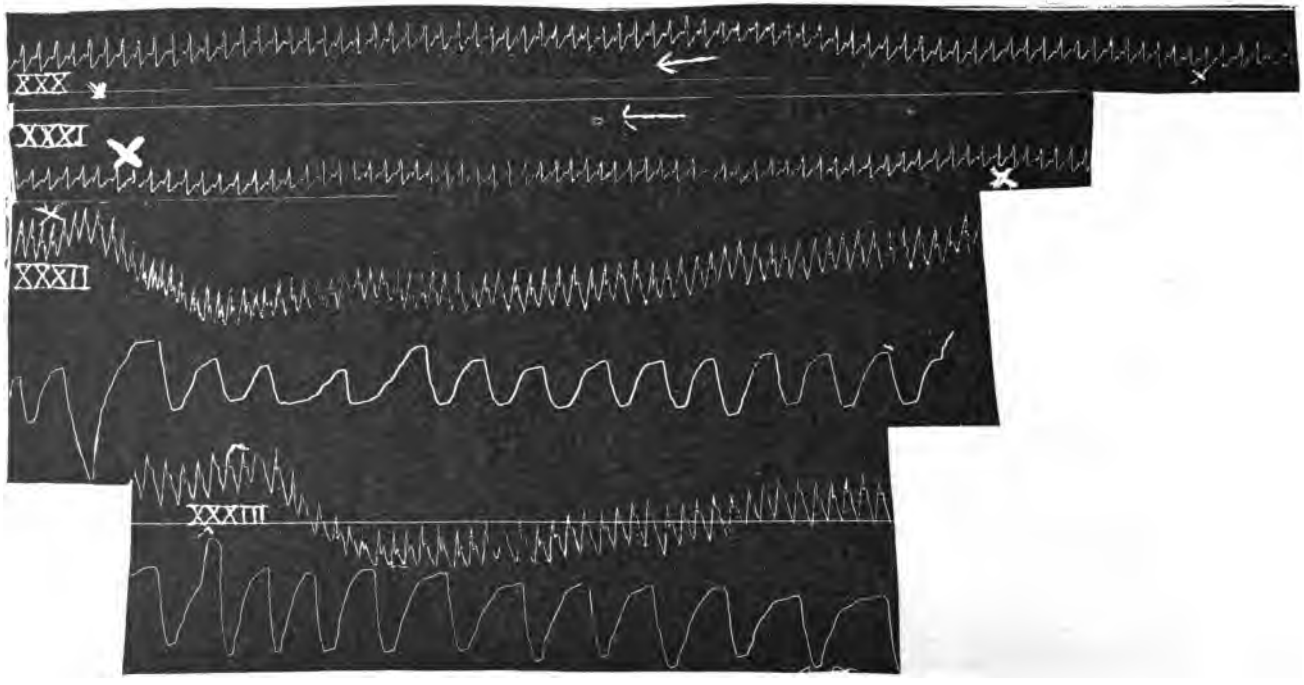


XXVI., XXVII., Addition; XXVIII., Memorizing; XXIX., Multiplication.

tion, for which the statements in the preceding paragraph are true in general, we find the wide variations in the accompanying bodily processes which our psychological analysis has led us to expect. Various sensory stimuli produce experiences of widely different intensities. A hot object touching the skin produces a much more intense experience than a colored light impinging on the retina, and, therefore, makes a much more imperative demand for attention. The shift from the preceding state to the new experience is much more sudden and violent in the case of the hot stimulus, and involves a rudimentary shock, which is entirely lacking in the color stimulation. The different bodily processes accompanying these two sensations are shown in Figs. XVII. and XVIII. The sudden violent changes in vaso-motor level accompanying the heat stimulus are much like those of the emotional experiences, while the slight gentle fluctuations of the color experience approach the mental application curves.

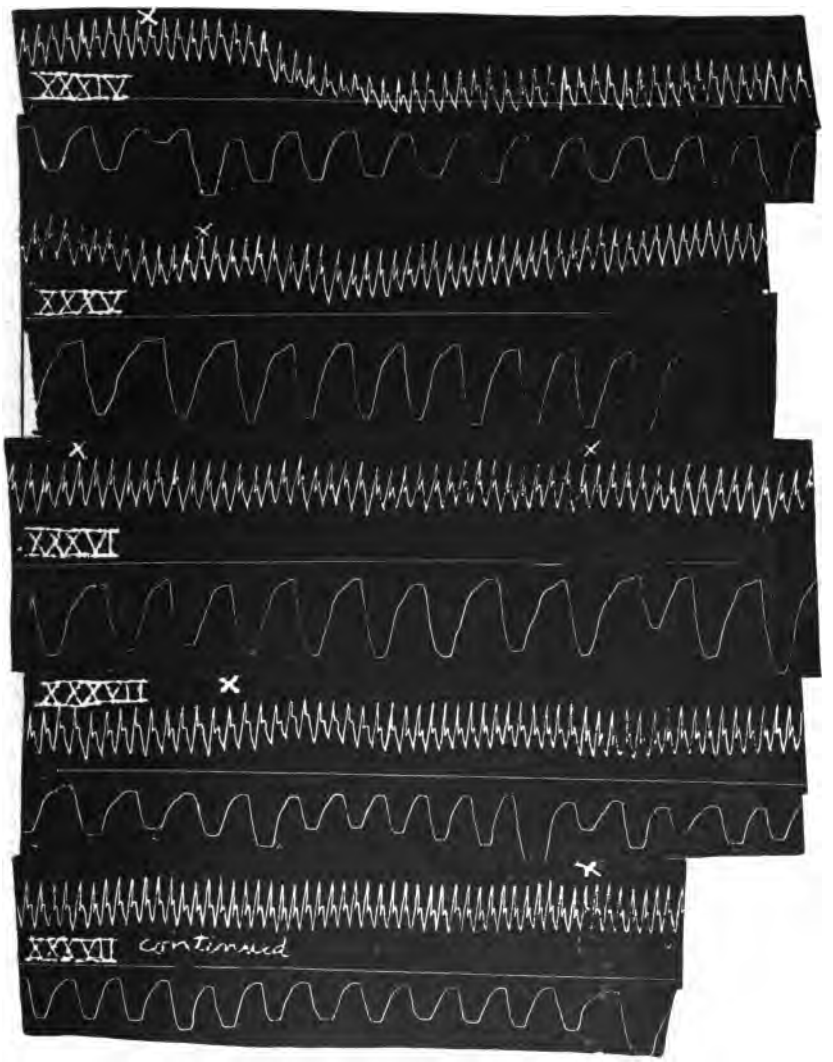
But even the same kind of sensory stimulus occasions states which differ greatly in intensity at various times, according to the actual physical intensity of the stimulus, the nervous irritability of the subject at the moment when the stimulus occurs, and the element of surprise involved. A loud noise, for instance, produces a much greater shock, and a correspondingly greater disturbance in the bodily processes, when it is unexpected than it does when the subject is prepared for it. Fig. XV. shows the effects of an unexpected noise. Fig. XIX. is a curve for noise taken at the same sitting, with the sole difference that in Fig. XIX. the noise was expected. The shock involved in the unexpected noise made the experience take on an emotional tone, which is reflected in the spasmodic change of vaso-motor level and amplitude, while the expected noise produces only a slight irregularity in the curve. When both noises are unexpected, a loud noise produces a much more violent shift of attention than a slight one. Fig. XII. is a characteristic curve for a loud noise, while Fig. XX. shows the effect of a slight noise upon the same subject. The contrast is much the same as that between the expected noise and the unexpected one. Furthermore, a stimulus which occurs while the subject is

PLATE VII.



XXX., Addition; XXXI., Multiplication; XXXII., Emotion, thought of friend's illness; XXXIII., Noise.

PLATE VIII.



XXXIV., Capsicum; XXXV., Knocking; XXXVI., Cross 1, Camphor; Cross 2, Rubber Cement; XXXVII., Addition.

nervously excited produces a muc hmore disturbing effect, and makes the readjustment of attention a much more difficult matter, than the same stimulus would if the subject were calm. Fig. XI. is the curve of a cold stimulus which occurred during a state of emotional excitement. Fig. XXI. is also the curve of a cold stimulus, given at the same sitting, but at a time when the subject was calm. The difference in the effect of the two stimuli is entirely disproportionate to the slight difference there may have been between the absolute intensities of the two.

The breathing during sensory stimulations undergoes irregular changes in rate and amplitude, more or less analogous to those of the pulse. An experience intense enough to cause a profound change in one usually shows itself in the other also (see Fig. XI.). When the experience is less intense it sometimes produces an effect on the pulse curve, but none on the breathing, although the reverse seldom happens. On the whole, the breathing in cases of sensory stimulations is characterized by slight spasmodic irregularities, usually of short duration (Figs. XI., XII., XIII., XIV., XXV.). With the weaker and less effective stimuli these are often lacking, and sometimes fail even with the more intense experiences (see Fig. XVII.). As compared with emotional states, the disturbances of the breathing during sensory stimulation are of less frequent occurrence and of briefer duration.

The search for uniformity in classes or kinds of sensory stimuli is as fruitless as it proved to be in the emotional states. An overwhelming majority of sensory stimuli of all kinds, whether agreeable or disagreeable, caused vaso-constrictions. The few cases of pronounced vaso-dilation do not correspond to the distinctly pleasant stimuli. The most distinctly pleasurable stimulus used, harmony, caused constrictions on all of the few occasions when it was given. Unpleasant odors, such as camphor and capsicum, caused dilations on a few occasions. Figs. XXII. and XXIII. are the curves for two disagreeable odors, both capsicum, given within a few minutes of each other to the same subject. As the curves show, one caused a slight dilation and the other a somewhat greater constriction.

The amplitude changes of the pulse curve show no greater

constancy in the direction of change for different kinds of stimuli than does the vaso-motor level. There is a great preponderance of decreases of amplitude over increases for sensory stimuli as a whole, but here again there seems to be no particular significance in the direction of the change for different experiences. For instance, disagreeable odors cause sometimes increase and sometimes decrease of amplitude (see Figs. XXII. and XXIII.). Cold is sometimes accompanied by a decrease of amplitude (Figs. XI. and XIV.) and sometimes by increase (Fig. XXI.). The relatively few cases of harmony among our tests all produced an increase of the amplitude of the pulse curve, a fact which suggests increase of amplitude as a correlate of pleasant experiences, until we notice that discords have the same effect.

The rate changes of the heart-beat during sensory stimulations are about equally divided between increases and decreases. Cold, noise, odors—in fact, all the stimuli of which we have any considerable number of tests—cause sometimes one and sometimes the other in a manner which, on present data, is entirely erratic. The cold stimulation shown in Fig. XIV. causes a slight temporary decrease of the pulse rate, while that of Fig. XI. is accompanied by a progressive increase. Figs. XXIV. and XXV. show the curves for two camphor stimulations, the first of which causes an increase of pulse rate and the second a decrease.

The dicrotic notch changes its emphasis and its position with reference to the apex of the pulse curve with as little regard to the nature of the stimulus as is shown by the other factors. With one subject the dicrotic, when it suffers any change at all, undergoes an almost uniform flattening during sensory stimuli of all kinds. With the other subject it is emphasized almost as often as it is flattened. The position of the dicrotic remains unchanged during the great majority of sensory stimuli for both subjects. When it is raised or lowered it happens apparently without reference to the nature of the stimulus.

The mental application tests used were chiefly simple arithmetical problems given as fast as the subject could perform them. In a few cases the memorizing of a series of nonsense syllables was employed. The curves of mental application are characterized by the slight amount of the vaso-motor changes involved, and

by the even progression in which changes in rate and amplitude take place, when they occur at all. The vaso-motor level usually shows slight fluctuations, although they are always less than the fluctuations of revery for the same day. Frequently the changes are so slight as to be scarcely noticeable (Figs. XXVI., XXVII. and XXVIII.). The respiratory rhythms disappear.

The breathing is more regular in most cases, although there are some exceptions. In memorizing nonsense syllables the breathing curve is broken up by a tendency to pronounce the syllables. In some cases of mental application, such as Fig. XXXVII. there are occasional irregularities. The fact that the breathing is under voluntary control, and that it is immediately affected by any tendency to use motor images of words, would lead us to expect that the uniformities would be less evident in that case than in the case of the purely reflex vaso-motor phenomena. As compared with emotional experiences and with sensory stimulations, and even with revery, the bodily processes accompanying mental application are characterized by greater stability and regularity. If our psychological analysis is correct, mental application is a state in which the attentive process is most stable, runs most smoothly and offers greatest resistance to change. Here, again, the correspondence between the degree of stability of the attentive process and the degree of stability of the accompanying bodily processes holds.

But as in the former cases, so in mental application, the direction of the various changes which do occur, offers no basis of classification which articulates with the psychological classification, either into intellective as opposed to affective states, or into agreeable as opposed to disagreeable states. The subjects found no distinctly affective tone in the various mental application tests used. Since no psychological classification on the basis of agreeable and disagreeable is possible in this case, it would be absurd to intrepret the vaso-dilations and constrictions as having such a significance. If the direction of the changes characterized intellective states as opposed to affective states we ought, of course, to expect to find some uniformity in the direction of change of mental application tests as a whole. But this is entirely lacking. In almost half

of the mental application tests the vaso-motor level shows both dilations and constrictions within a single test (Figs. XXVI., XXVII. and XXVIII.). Where the vaso-motor level changes in only one direction it seems to be an even chance whether it shall be a dilation or a constriction. Frequently there is no change of level. Fig. XXIX. illustrates a mental application test where there is only constriction and Fig. XXXVII. one where there is only dilation.

The amplitude of the pulse curve in mental application shows a greater tendency to decrease than to increase. In all of the few tests made, which exceeded two minutes in time, there was a marked decrease of amplitude at the end, even when there was an increase at the beginning. But among the tests of shorter duration there were several where the amplitude increased without any subsequent decrease. The pulse rate of mental application shows a greater tendency to increase than to decrease, but the cases of decrease of rate, although less numerous than those of increase, are frequent.[1] But, whatever the direction of the change, it takes place slowly and gradually. (See Fig. XXXVII. for increase of pulse rate and Fig. XXXI. for decrease of rate.)

The rate and amplitude of the breathing curves change in contrary directions during mental application in quite as erratic a manner as the pulse curves.[2] One subject shows an almost uniform increase of breathing rate, while the other has a few more cases of decrease than of increase. With both subjects the amplitude is more often decreased than increased, but there are frequent cases of increase. (See Fig. XXVII. for increase of breathing amplitude and Fig. XXXVII. for decrease.)

As a summary of the results of these experiments, we can offer nothing better than a series of tests illustrating each of the different types of processes from curves obtained at a single sitting of about an hour's duration. There is first the emotional experience of the sudden thought of a friend's illness (Fig. XXXII.),

[1] Most investigators report much greater constancy in the cases of increase of rate in the heart under these conditions. Certainly it is the most usual occurrence.

[2] MacDougall and the French writers report increase in rate and decrease in amplitude as constant. Delabarre's observations suggest a considerable difference in individuals in this respect.

with its marked fall in vaso-motor level and its irregularity in all the features of pulse and breathing curves. Next comes the startling noise (Fig. XXXIII.), which involves as sudden and violent a shift of attention as the emotion and produces a very similar curve. Next in order is a disagreeable and annoying odor—capsicum (Fig. XXXIV.). In this case the vaso-motor fall is less, though still very evident, and irregularities in amplitude and rate are decreased. The slight disturbance caused by an unexpected knock at the laboratory door, makes still less of a fall in vaso-motor level, but yet shows other irregularities (Fig. XXXV.). The odors of camphor and rubber cement, which were not at all annoying unless strong, produce no marked change in the curve (Fig. XXXVI.). The slight shifts of vaso-motor level, and slight irregularities of rate and amplitude, resemble closely those of the preceding state of revery. No strong demand for attention is made by them. Finally, mental application (Fig. XXXVII.) produces a steady strain of attention, which is accompanied by a curve practically devoid of fluctuations in vaso-motor level, with an amplitude which is almost constant, and a slowly, progressively increasing rate.

All the processes with which we have been dealing are cases of readjustment of an organism to its environment. Attention is always occupied with the point in consciousness at which the readjustment is taking place. If the process of readjustment goes smoothly and evenly, we have a steady strain of attention —an equilibrated motion in one direction. The performance of mental calculation is a typical case of this sort of attention. But often the readjustment is more difficult. Factors are introduced which at first refuse to be reconciled with the rest of the conscious content. The attentive equilibrium is upset, and there are violent shifts back and forth as it seeks to recover itself. These are the cases of violent emotion. Between these two extremes comes every shade of difficulty in the readjustment, and of consequent intensity in emotional tone. We have attempted to show in the preceding paper that the readjustment of organism to environment involves a maintenance of the equilibrium of the bodily processes, which runs parallel with the maintenance of the attentive equilibrium, and is an essential part of the readjustment of the psychophysical organism.

[Reprinted from THE PSYCHOLOGICAL REVIEW, Vol. V., No. 2, March, 1898.]

HABIT AND ATTENTION.

In the third volume of this REVIEW there appeared a report of some reaction experiments conducted by Mr. A. W. Moore, Mr. J. J. Jegi and myself. We advanced in schematic form a general theory interpretative of the relations of habit and attention, contending that the conception presented, while strikingly confirmed by the outcome of our experiments, afforded for the contradictory results of previous observers a reconciliation more vital and fundamental than any before attempted. The Baldwin and Flournoy theories of reaction both mark distinct advances upon the Leipzig position, which in its extreme form is surely no longer tenable, but neither of them affords a thoroughly satisfactory and complete explanation of the facts as shown under practice, and it is precisely here that the strength of our hypothesis makes itself felt. Owing no doubt to our lack of clearness in exposition, no one of our reviewers, so far as I am aware, appears quite to have caught the force or significance of our contention. Since the publication of our report two of my students[1] have made a series of experiments dealing with the same phenomena, and I take the verification of our position shown by their work as an excuse for adding a few words in further explanation of our view.

Put briefly the doctrine runs as follows: All so-called voluntary action requires for its execution concatenated series of sensory and motor activities. Thus, for example, the placing of a book upon a table requires a complex interlinking of muscular contractions with articular and tactile sensations. Early in childhood the execution of acts of this general character becomes relatively automatic, so that, despite slight variations in individual performances—due to trifling changes in the conditions—the acts obviously belong under the head of habit. Listening, watching and other acts involving strain of attention toward an expected stimulus manifest the presence of habit in characteristic bodily attitudes, which are really sensory-motor coördinations of a less overt type. Movement of the hand in response to a stimulus of sound, as in the reaction experiment, involves accordingly not alone habitual contractions in the muscles of the hand, but also an attitude of listening, which is itself essentially habitual. Moreover, the

[1] Miss Edith Schwarz and Mr. E. H. Mahood. They made over 4,000 reactions, divided about equally between them.

execution of the act of listening will be vitally influenced by considerations touching the situation as a whole. It will not be done in quite the same way, if the result of the hearing is to be a movement of the foot instead of the hand, and, conversely, the movement of the hand, as an habitual act, will not follow in an identical manner upon a stimulus of sound and one of light. The greater the qualitative divergencies in the nature of the stimuli and responses respectively, the greater the discrepancies in the results. The experiments show this with perfect clearness. In short, the reaction experiment represents an act in which are united two subordinate groups of habitual coördinations, one at the sensory end of the arc and one at the motor end.[1]

Now, the function of attention in this process is found in the fact that some of the elements in these interrelated sensory-motor groups are imperfectly connected and require in consequence more accurate coördination. Given a situation where a sensation is to be the signal for a movement, where the getting of the sensation involves a small group of coördinations habitual in type and the movement itself necessitates another such group, the function of attention will be found at that point where the various coördinations comprised in the total sensation-and-movement act are least perfect, least thoroughly habitual. Interpreted still further in terms of the reaction experiment this will mean that some persons, if asked to perform the reaction, say from sound to hand movement, will find that they naturally and almost inevitably put their attention upon the hand part of the process; that in this manner they react more rapidly and, on the whole, more regularly. With others the exact converse maintains, while not a few find their attention vibrating between the extremes. Attention goes, if one may so express it, to the point of greatest resistance. If we insist that the subject place his attention on some other part of the process, the results show highly irregular reactions. This simply means that with an unpractised subject the coördinations involved in reacting are very unevenly developed, some being more or less perfect and others relatively imperfect. This is exactly what we should anticipate and requires no explanation. If the sensory end of the performance chances to be least reflex and consequently more in need of assistance, removing the attention to the other end of the arc will not only take away the mediation of consciousness from the point where it is most needed,

[1] A view of this general character suggests the necessity for considerable modification in the meaning ordinarily given the terms sensory and motor, both as applied to imagery and to the more immediately peripheral processes. Cf. u. Biervliet, Images sensitives et images motrices—*Revue Philosophique*, 1897; Professor Dewey, Reflex Arc Concept—PSYCHOLOGICAL REVIEW, Vol. III.

but it will also probably tend to split up the more perfect and approximately unconscious habit at the other end by emphasizing and so discoördinating some of its constituents. Thus our point of view, in distinction from a prevalent psychological doctrine, emphasizes the close functional relationship of habit and attention, rather than their polarity and antithetical nature.

If this general statement of the factors involved in reaction be correct, there is obviously no reason why the coördinations employed should be insusceptible of the same kind of training which characterizes all growth in habit. Accordingly a person manifesting at the outset marked subjective preference for the motor form of reaction, with relatively rapid and regular results, ought to be able, other things being equal, to develop a similar capacity for reaction in the sensory form, so that eventually he should minimize, if not obliterate, the differences in the outcome of the two forms.[1] I say, 'other things being equal' because we shall here, as elsewhere, meet with limitations in the degree of facility with which new coördinations are adopted. Very few persons, for instance, are capable of any high development in the mere muscular technique of piano playing, and, while discipline will generally do much, its limits are sooner or later inevitably encountered. As the reaction-times represented by the two forms draw together under practice, both of them should become more rapid and more regular. Personal peculiarities will probably tend to render one form permanently more rapid, but there is no reason why this form should be the same for all individuals, and in cases at all susceptible to drill the differences ought to be relatively small anyhow. On the other hand, our position offers, along the lines already indicated, a thoroughly cogent account of those cases, emphasized by the earlier investigators, where the reaction-times of the two forms show under practice little, if any, tendency to approximation. I am strongly of the opinion that these cases will be found relatively infrequent, if the experimentation is (1) free from strong preconception on the part of the subjects regarding the outcome and (2) if it is carried on long enough to pass through certain well-marked transitional stages.

A few citations from the experiments, which afford me the excuse for this statement, will illustrate the points I have been presenting. Early in the course of experimentation one of the subjects shows, as a

[1] I disregard the various modes of reaction included under the general terms sensory and motor respectively, not because I distrust the genuineness or value of the distinctions concerned, but simply because their truth or falsity leaves wholly unaffected the point I am at present urging. As a matter of fact our original article contains mention of several clearly differentiated forms and Baldwin and Flournoy contribute a much fuller list.

result of 80 (ear-hand) reactions taken on one day in the sensory form, an average time of 198σ with a variation of 38σ; 96 experiments taken under similar conditions a month later show the average time reduced to 138σ with a variation of 27σ. In the same period the motor form, starting (85 experiments) with an average time of 158σ and a variation of $39\sigma+$, has come down (52 experiments) to 132σ with a variation of $19\sigma+$. This shows the development progressing, but not yet complete. Both forms are growing faster, and the sensory, which was originally the slower, is gradually approximating the time of the motor, while the variation for both forms dwindles. The other subject shows in the first half of 674 (ear-hand) reactions taken in the sensory form an average time of 176σ with a variation of 21σ. In the second half the figures are 161σ and 16σ. Out of 718 (ear-hand) motor reactions the first half gives the figures 153σ and 15σ, the second half shows a decrease to 135σ and 13σ. 387 ear-lip reactions taken in the sensory form, and after benefit of the practice from the tests just mentioned, show in the first half 127σ and 14σ; in the second half 119σ and 11σ. 456 motor reactions of the same kind give in the first half 115σ and 9σ, in the second half 112σ and 8σ. In the second subject's ear-hand reactions the increasing rapidity of both sensory and motor forms is clearly shown, although the approximation of the one to the other has not yet set in. In the same subject's ear-lip reactions, however, this approximation is already obvious.

It must not be supposed that the approximation of the reaction-times means a complete merging of one form in the other. Not only do the mean variations show a real difference, but also the unanimous verdict of the subjects is, that under practice the differentiation of the sensory and motor forms is increasingly clear and easy, the varying direction of attention being perfectly unmistakable, however ambiguous it may have been at the outset. As the various coördinations involved approach completeness and perfection, it becomes more and more a matter of indifference where the attention is directed. The environment is probably never so fixed and unchanging—to say nothing of the organism itself—that the coördinations in response to it are not capable of being slightly bettered by the presence of attention, otherwise the whole process would ultimately become automatic and essentially unconscious. The changing situation, both without and within, alone prevents such an outcome. At all events, this appears to be the case so far as concerns those particular coördinations involved in the reaction experiment.

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STUDIES FROM THE PSYCHOLOGICAL LABORATORY OF THE UNIVERSITY OF CHICAGO.

COMMUNICATED BY PROFESSOR JAMES ROWLAND ANGELL.

AN INVESTIGATION OF CERTAIN FACTORS AFFECTING THE RELATIONS OF DERMAL AND OPTICAL SPACE.[1]

BY JAMES ROWLAND ANGELL, JESSIE N. SPRAY, E. W. MAHOOD.

The experiments reported in this paper deal with two problems touching the relation of dermal and optical space. (1) What effect does the absolute weight of the dermal stimulus exercise upon the comparison of linear extents sensed by the skin with linear extents seen? (2) What effect does the temperature of the dermal stimulus exercise upon the same comparison? The dermal space judgments are all based on cutaneous as distinct from tactual stimulations, *i. e.*, they involve passive and not active pressure. The optical judgments rest on direct vision. No attempt was made to exclude eye movements.

Before passing on to a description of apparatus and method we may profitably pass in review very briefly some of the experimental observations upon matters immediately cognate to our inquiries.[2]

Numerous investigations have been made upon the sensitiveness of various areas of the skin to stimulations with two points,

[1] The experiments described were actually executed by the two persons whose names appear with my own at the head of the article. They deserve whatever credit belongs to the careful, painstaking supervision of the work, the preparation of apparatus and the construction of tabular reports. I am responsible for any shortcomings in the general method employed and in the form of presentation of results. J. R. A.

[2] The very complete bibliography in M. Henri's scholarly monograph 'Ueber die Raumwahrnehmungen des Tastsinnes' renders any extended reference to the literature of the subject superfluous. We may preface our statement by saying that in none of the literature to which we have had access is there any account of investigations upon our immediate problems.

applied both simultaneously and successively.[1] The different parts of the body are found to vary very widely from one another. Vierordt's formulation, which is only roughly accurate, states that the limen is smaller the more mobile the part concerned.[2] Children and blind persons are more sensitive than normal adults. Bearing more closely on our work are the observations of certain investigators upon the effects of changes in pressure on the limen for double-point discrimination. The results are not in agreement with each other, some reporting no effect following change of pressure, others finding the limen smallest when the stimulations are relatively intense. Henri reports a variation in effects of pressure as dependent upon the special area selected.[3] When the points are of different temperatures, the limen falls. When both points are cold, the discrimination is more delicate than when both are warm, but the best results occur when the points are at the skin temperature.[4] On the arm the limen is smaller in the transverse than in the longitudinal direction. The more delicate the discriminative capacities of any area of the skin, the greater is the apparent distance between points stimulated upon this area.[5] The distance between two points on the skin is usually underestimated. Wundt found that this underestimation decreased with increasing pressure, but he gives no detailed statements of the observations and his method seems to have involved the adjusting of dividers by his subject in a peculiar manner.[6] The apparent distance between two dermal point stimuli is decreased if they follow stimuli nearer together, and increased if they follow stimuli further apart. That is to say, cutaneous experiences of this character are subject to effects of contrast. The distance between two points on the skin is felt as greater than the length of a line objectively equal to it.[7] Both in the judgment of cutaneous space

[1] Judd, *Phil. Studien*, 1896.

[2] Vierordt, *Zeit. für Biologie*, 1870.

[3] Raumwahrnehmungen des Tastsinnes.

[4] Goldscheider, Du Bois-Reymond, Archiv, 1885. Klug, Wärmerortsinn, *Arbeiten d. physiol. Anstalt*, Leipzig, 1876.

[5] Fechner, Abhandl. Sachs. Gesell. d. Wiss., Leipzig, 1884.

[6] Wundt, Theorie d. Sinneswahrnehmung.

[7] Nichols, Our Notions of Number and Space. Parrish, *Amer. Journ. Psychol.*, VI. and VIII.

and in the localizing of cutaneous stimulations, it is probable that with many persons visual imagery plays a conspicuous part.[1] When compared with visual extents, stimuli involving tactile and articular elements are regularly underestimated.[2] These seem to be the points most definitely established, which concern more or less directly our problems and results.

Apparatus and Method.

For giving the cutaneous linear stimulations a series of cards of various lengths was employed. Those used in the tests involving temperature were made of thin brass, while those employed in the other tests were of stiff rubber. These cards were, by means of a simple device, clamped into one of Professor Jastrow's æsthesiometers, provided with a cup at the top for the reception of weights. This instrument is so constructed as to insure equal pressure over the area stimulated and is too well known to require further description.

The cards ranged from ½ cm. to 10 cm. in length, each differing from the one next it by ½ cm., with the exception of those between 1 cm. and 2 cm. These differed from one another by ¼ cm. These lengths were determined by the results of preliminary tests of investigation and control. The shortest length selected was that at which under all the conditions of the experimentation the stimulus was felt as linear and not merely punctual. The longest length was determined by the possibility of applying the stimulus evenly throughout its whole length. The increase in the number of steps between 1 cm. and 2 cm. results in somewhat richer data over this part of the scale. It has no other significance. Each card was 1.75 mm. thick.

The brass and rubber cards were exact duplicates of each other and the utmost care was exercised to secure smooth, even surfaces of contact. Moreover, all the cards were of precisely the same weight. This permitted us in the tests with changing temperatures to keep the weight of the stimuli objectively equal,

[1] Washburn, *Phil. Studien*, 1895.

[2] Henri, Op. cit. Jastrow, *Mind*, XI.; *Am. Journ. Psy.*, III.

whether a long line or a short line was being used. We did not attempt to secure subjective equality of pressures. We were also enabled by means of this arrangement to make all changes of weight, in the tests where the temperature was kept constant, directly upon the æsthesiometer and without regard to the length of the stimulus being employed.

The different degrees of pressure were obtained by adding or removing weights from the cup of the æsthesiometer. Inasmuch as our problem concerns the effect of increase and decrease of pressure upon the linear judgments of the skin, we have confined most of our experiments to ranges where the stimulus produces a relatively clear and distinct impression, avoiding on the one hand such stimulations as are very close to the pain limen, and on the other hand those which lie so near the pressure limen as to be hopelessly vacillating and vague. We have made a limited number of tests, however, covering both points. The weights used (this is the total weight of the apparatus as it rested on the skin) were as follows: 31.47 g., 35.47 g., 39.47 g., 43.47 g., 47.47 g., 51.47 g., 55.47 g. It will be seen that there are three weights above and three below 43.47 g. Each weight differs from the next above by 4 g. This increment was selected because it was found to involve a just easily noticeable difference, when attention was directed to the pressure. The weight 43.47 g. is referred to in the following pages as the 'normal,' because the effects of the lighter and heavier weights are compared with it as a standard.

The thermal changes were secured by heating and cooling the brass cards. Three different degrees of cold were used, viz., 9°, 13°, 18° Centigrade, and three degrees of heat, viz., 40°, 45°, 50°. Judgments based on these compound thermal-pressure stimulations are compared with those based on the thermally indifferent stimuli, *i. e.*, those at the physiological zero. It is for several reasons exceedingly difficult to obtain linear stimulations which are absolutely indifferent thermally. Among other reasons may be mentioned the sensitiveness to mechanical stimuli of the neural apparatus for temperature. In the appreciable interval between the removal of the stimulus

card from the temperature chamber and its application to the skin, there is necessarily a slight change in its temperature, which makes the record of our tests upon this subject less accurate, absolutely considered, than are those upon pressure. As representing, however, the direction and general nature of the changes produced by the introduction of thermal elements, we believe the results are thoroughly reliable. The particular temperatures adopted were selected as representing the change from the physiological zero, through mild but distinct thermal sensations, up to those whose intensity renders the temperature portion of the experience distinctly paramount to the pressure portion.

The optical stimuli consisted of black, horizontal lines drawn exactly parallel with one another on a large white card, 55 cm. by 35 cm., with a black margin 2 cm. in width. A space of .5 cm. was left between each pair of lines, so that each line was seen clearly by itself. The lines were arranged in the order of length, beginning with a mere dot and ending with a line 12 cm. long. This procedure practically eliminates the effects of contrast, as each line is midway in length between its two neighbors. The only exceptions to this statement are the two extremes, which are as a matter of fact of no importance, for reasons which will appear shortly. Each line differed from the one next it by .125 cm. It will be observed that this approximates the just noticeable difference of visual extent for lines in the median portion of the scale, being somewhat too large for the shorter lines and too small for the longer ones. The scale might easily have been made to conform to the law for such judgments, but it did not appear that any material gain would accrue for the present purpose. Each of the dermal cards corresponded exactly in length to one of these visual lines. There were, however, 97 visual lengths and only 22 dermal lengths. Except in the range from 1 cm. to 2 cm. there were three visual lines intermediate in length between any two consecutive dermal lines; from 1 cm. to 2 cm. there was only one intermediate line. But it will be remembered that in that portion of the scale the dermal stimuli are more numerous.

In the present experiments the cutaneous stimuli were ap-

plied to one area only. Starting at a point on the volar side of the forearm, about 15 mm. above the wrist joint, a tract was mapped out a trifle less than 4 mm. wide, extending up the long axis of the arm toward the elbow. One extremity of the dermal cards was always placed upon this starting-point, so that the area stimulated was kept as constant as possible. The most comfortable position of the arm and body was of course sought, in order that fatigue might not enter as a disturbing element. To insure this result still further, the morning hours from 8.30 to 10 were employed for the work.

An illustration will now make clear the actual procedure in any particular test. The subject sat with closed eyes just before a table upon which, at a convenient distance, was placed the chart of visual lines. The operator gave a verbal signal 'ready' and a moment later applied the dermal stimulus to the subject's arm, allowing it to remain in place for somewhat less than two seconds, which was found by experiment to be the most favorable time for its clear perception. The stimulus was then removed; the subject opened his eyes and selected from the visual lines the one judged equal in length to the dermal stimulus. It will be seen that this is essentially an application to the present problems of the method of average error.

We venture to emphasize once again (1) that only one area of the skin is concerned in this report; (2) that only stimulations parallel with the long axis of the limb are involved; (3) that only horizontal visual lines are concerned, and (4) that only such judgments are at issue as consist in comparing a previously experienced dermal stimulus with a sequent visual stimulus, never the reverse. The probable bearing of certain of these limitations on the general interpretative value of our results will be canvassed later on in the paper. Suffice it to say that certain of these matters are to be investigated more fully. Meantime it may be added that, by limiting the field in this way, we are enabled, within the bounds indicated, to put a larger degree of confidence in our tests, which number upwards of 6,500, than would otherwise have been the case.

The experiments were made upon two persons, one serving as subject for the temperature tests, the other for the pressure

tests. Slightly less tests were made on temperature than on pressure. With both subjects, as has been mentioned, preliminary practice tests were made with constant pressure and temperature. These are neglected in the tables and curves. It is a matter of regret that tests could not be made on more persons.

In order to minimize the possible effects of expectation the subject was kept in ignorance of the order in which the stimuli were given. As a means of baffling speculation on the part of the subject regarding this order, and also as a means of equalizing any effects of dermal contrast, the procedure was varied in a number of ways. Sometimes the shorter lines were employed first and then the lengths gradually increased. Sometimes the reverse order was followed. Again the two methods were combined with various modifications, and finally some of the tests were made with utter disregard of any regular order. As a matter of fact the subject soon ceased to pay any special attention to the order, and the unconscious effects of contrast are quite certainly reduced to a negligible quantity, if not, indeed, wholly eliminated. A similar method was employed regarding the thermal and pressure variations, each one of which necessarily involves all the lengths of lines. In order that the effects of practice might be evenly distributed over the judgments involving such changes from the normal pressure and temperature, care was exercised to alternate the tests every two or three days. Accordingly no one length of line and no one degree of temperature or pressure is at any material advantage as compared with any other. The tables and curves are computed on the basis of the averages for the whole period of experimentation under such equalizing conditions, except when explicitly otherwise stated. Thus, for example, upon days when temperature or pressure tests were made involving departure from the normals, there would always be a series of normal tests at the outset and another series at the close of the sitting. In order to avoid confusion and vacillation in the judgments, only one variation from the normal, either as regards pressure or temperature, was ever made upon the same day.

Attention was called at the outset to the fact that only the long axis of the arm was used in making the cutaneous stimula-

tions. That a difference exists in the spatial judgments, which arise when a stimulus is applied in different directions to the forearm, is of course well known. This fact, like the difference in the space judgments arising from cutaneous areas more widely separated, makes it impossible to employ our results as representative of other cutaneous surfaces, although it does not seem probable that the direction of the changes noticed would be materially modified. If, as Henri states, pressure affects judgments of point distances very differently for different cutaneous localities, then our experiments dealing with lines are probably significant only for the special area investigated.

Similarly we must limit our statements on the side of the visual lines to such as are horizontal. But inasmuch as vertical lines are generally overestimated when compared with horizontal lines, it will be seen that our procedure will tend to diminish rather than to magnify the disparities between the cutaneous and visual extents.

It is hoped that experiments may be carried out reversing the procedure in these and comparing, by the method of right and wrong cases, visual extents with sequent cutaneous extents.

Results.

I. Judgments Based on Variable Pressures.

The curves in figures 1 and 2 furnish a graphic presentation of the judgments under varying pressures of the dermal stimulus. It will be noticed that at the 'normal' pressure, *i. e.*, 43.47 g., the very short cutaneous lines varying from .5 cm. to 1.25 cm. are overestimated when compared with visual lines; from that point on, however, all the cutaneous lines are underestimated. This underestimation is relatively greatest between the lengths 2 cm. and 3.5 cm. and is only in slight measure exceeded absolutely by the underestimation of lengths from 7.5 cm. to 8.5 cm. Elsewhere in the scale there are relatively small wave-like fluctuations.

Just what may be the precise grounds, physiological and psychological, of the differences in the space perceptions of disparate senses we have at present no intimation; granted, how-

ever, a tendency, as in this instance, to underestimate cutaneous linear space, when compared with visual linear space, we might anticipate that an increase in the pressure of the cutaneous stimulus would, by bringing out more clearly unnoticed dermal sensations, tend to increase the felt size of the object and so reduce

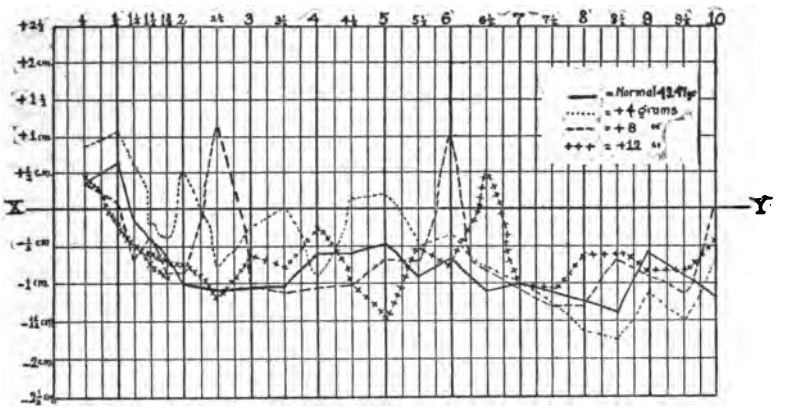

FIG. 1. Showing the average error in cm. of the judgments for the different lengths of apparatus and the direction of the error for the different pressures above the normal. The numbers on the line XY indicate the lengths of the cutaneous stimuli. Where the curves run below the line, underestimation is indicated; *i. e.*, a visual line shorter than the cutaneous line is selected as being equal to it. Overestimations are represented by points on the curve above the line XY. The horizontal lines above and below XY represent .5 cm.

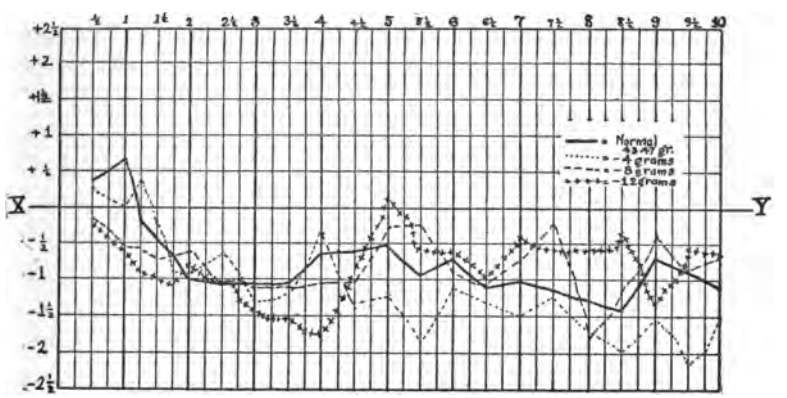

FIG. 2. Showing the average error in cm. of the judgments for the different lengths of apparatus and the direction of the error for different pressures below the normal. For further explanations see Fig. 1.

the underestimation. A point could then be determined where the underestimation was at a maximum. Above this, every increase in pressure, up to the point of annoying intensity, should be accompanied by decrease—or, indeed, a possible reversal—of the error. We should, moreover, expect the average variation of successive judgments to grow greater toward both extremes. This was, in point of fact, what we anticipated, and is, with some unforeseen modifications, what the results show.

The general principle is illustrated in the judgments upon the lines shorter than 1.25 cm. Here, oddly enough, the usual relation is inverted and the normal cutaneous line is overestimated. The increase of 4 g. results in still further overestimation, as we should expect, but the increase of 8 g. and 12 g. does not add to it. This is a symptom of what the curves show all through, *i. e.*, that the heavier weights produce irregularities and relatively large variations in accordance with our expectations. Not until the 35.47 g. weight is employed do we get a reversal and a consequent underestimation. In the ranges from 1.5 cm. to 5 cm. all four of the lightest weights are underestimated. The general effect of increasing the pressure over this part of the scale is to reduce the error. Two of the heavier weights produce occasionally an overestimation, but irregularity is again a feature of their results. Between 5.5 cm. and 6.5 cm. we appear to have a turning-point. The two heaviest weights produce marked overestimations here, after which all the remaining lines are underestimated regardless of the pressure.

A series of tests was made, which was not extensive enough to incorporate in these curves, showing the effect of very heavy and very light stimuli. Tests with 143.47 g. produced no marked change in the results. Underestimation was still the prevalent error, with no noticeable alteration in the amount of the error as compared with the normal and with a fair percentage of correct judgments, viz., 20%. Tests with weights of 20.27 g. and 9.2 g. resulted in large underestimations and great subjective difficulty in making the judgments. When, however, as in two series of tests, the lines were kept the same —the longest and shortest were used—while the widest varia-

tions possible were made in the pressure, the errors became few and small, although they still consisted of underestimations.

Summing up on these points, then, we may say: (1) That for all degrees of pressure the dominant tendency in comparing cutaneous linear stimuli from the volar surface of the forearm with horizontal visual lines is toward underestimation. (2) The amount of this underestimation decreases with increasing pressure up to certain limits and may at points give way to overestimation. (3) The degree of pressure productive of such overestimations and reductions in underestimations is not constant for different linear lengths. (4) Except for light pressures of 35 g. and under, there is a distinct tendency to overestimate lines shorter than 1 cm. In our tests this tendency reaches a maximum at 43.47 g., and at 143.47 g. has fallen to zero again.

TABLE I.[1]

Average percentages for all lengths of apparatus.

	CORRECT JUDGMENTS.	UNDERESTIMATIONS.	OVERESTIMATIONS.
Normal Pressure.	15	67	18
Increasing Pressure. 4 grams.	14	56	30
Increasing Pressure. 8 grams.	14	55	31
Increasing Pressure. 12 grams.	12	63	25
Decreasing Pressure. 4 grams.	11	73	16
Decreasing Pressure. 8 grams.	12	69	19
Decreasing Pressure. 12 grams.	9	76	15

[1] It is planned to reprint these studies at a later date in connection with other reports of experiments made in the University of Chicago laboratory. More complete tabular statements will be made at that time. The average variation is small, the figures for one subject, for example, grouping themselves under all conditions closely about 0.14 of the length of the stimulus.

Table I. presents the results in terms of tests underestimated, overestimated and correctly judged under the various conditions. This disregards the amount of such overestimation, but inasmuch as the amount of the errors is in part determined by the method employed, with its limited number of possible selections from among the visual lines, these tables are, perhaps, quite as representative as the curves.

As the pressures increase, the decrease in the regularity of the judgments, which was commented on a few lines back, is shown by the decreasing percentage of correct judgments. The general trend is toward a reduction of the number of underestimations, but the heaviest weight is less effective than either of the other two above the normal. The same decrease in percentage of correct judgments is noticeable in the case of decreasing pressures, and we meet with practical regularity in the increase of underestimates. The next to the lightest weight is, however, slightly less effective in this regard than its heavier neighbor.

TABLE II.

Showing effects of practice for three typical stimuli at normal pressure and temperature.

LENGTH OF STIMULUS.	ERROR AT BEGINNING.	ERROR AT CLOSE.	
.5 centimeter.	+ .99 — .15	—.2 .0	Subject A. Subject B.
4.5 centimeters.	— .65 — .43	—.04 —.2	Subject A. Subject B.
10 centimeters.	—1.54 — .4	—.86 —.19	Subject A. Subject B.

Table II. shows the effects of practice. The results suggest that the disparity between cutaneous and visual linear space as we have it here is very deep-seated in the organism, for the unmistakable tendency is toward a permanent retention of the characteristic underestimation. This affects even the short lines generally overestimated.

II. JUDGMENTS BASED ON VARIABLE TEMPERATURES.

Figures 3 and 4 exhibit the effects of the variations of temperature upon the judgments under consideration. It will be

seen at a glance that the departures from the normal are much more marked than in the case of the pressure tests. As in the oft-quoted instance of apparent increase in size and weight of

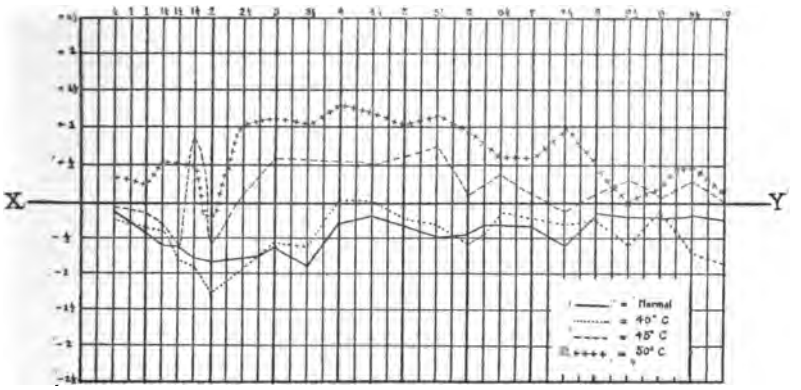

FIG. 3. Showing the average error in cm. of the judgments for the different lengths of apparatus and the direction of the error for the different temperatures above the normal. For further explanation see Fig. 1.

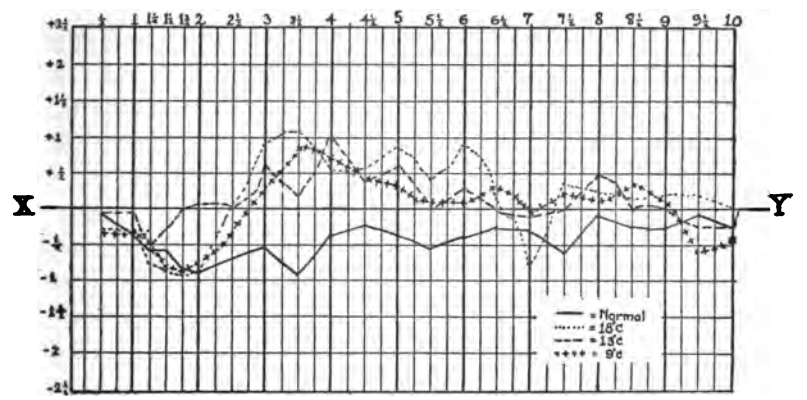

FIG. 4. Showing the average error in cm. of the judgments for the different lengths of apparatus and the direction of the error for the different temperatures below the normal. For further explanation see Fig. 1.

cold objects, *e. g.*, a silver dollar, we may expect that the dermal stimulus will be felt as longer than under the ordinary conditions. This is exactly what occurs. Taking the curves as a whole, the unmistakable tendency resulting from the use of hot and cold stimuli is to reduce the amount of underestimation of

the cutaneous line, and with the extremer temperatures this underestimation gives way to a pronounced overestimation. But even with those temperatures which are most effective in changing the direction of the error, we observe, as in the pressure tests, certain points at which the estimation of the cutaneous stimulus seems to rest upon factors that are in large measure independent of the absolute pressure and the absolute temperature. Thus it will be noticed in Fig. 3 that the dermal line 2 cm. in length is persistently underestimated with the coldest temperatures, as well as with those up to and including the normal, although the lines on either side of it are with those more intense temperatures overestimated. It is, furthermore, just at this point that the hot stimuli begin to produce departures from the normal underestimation. The lines 7 and 7.5 show a similar tendency to revert to the primary underestimation, only the very hottest stimulus displaying resistance to the tendency. The subject upon whom these temperature tests were made shows a noticeable disposition to increased accuracy of judgment with the longer lines, both for the normal tests and for the temperature tests. The very short lines are also judged with considerable accuracy, while those of medium length show the largest errors.

Turning to Tables I. and II. it is interesting to observe that under the 'normal' conditions the percentage of correct judgments, overestimations and underestimations is for our two subjects almost identical. Each has 18% of overestimates, but the subject for the temperature tests has 66% of underestimates and the other subject 67%, the percentage of correct judgments being 15% and 16% respectively. This fact, together with the general similarity of the two normal curves, as seen, for example, in Figures 1 and 3, permits a more confident comparison of the general results of the two experiments.

Table III. shows that with the introduction of moderate heat we meet increasing irregularity of judgment, only 9% being correct, although the percentage of underestimates is slightly enlarged. As the heat is made more intense, the predominance of underestimates rapidly gives way to a large predominance of overestimates. In the case of the hottest stimulus this is accompanied by the same percentage of correct judgments as with the least intense heat stimulus.

TABLE III.

Average percentages for all lengths of apparatus.

	CORRECT JUDGMENTS.	UNDERESTIMATIONS.	OVERESTIMATIONS.
Normal Temperature.	16	66	18
Temperature 50° C.	9	16	75
Temperature 45° C.	15	31	54
Temperature 40° C.	9	69	22
Temperature 18° C.	19	37	44
Temperature 13° C.	20	40	40
Temperature 9° C.	13	44	43

Table III. also shows that with the particular temperatures employed the cold was less effective in producing large numbers of overestimates than the heat. When the amount of the overestimates is taken into account, however, as distinct from the mere number of such judgments, the disparity is very small. This will readily appear from comparing Figures 3 and 4. Moreover, the percentage of cases of overestimates and underestimates arising with the different degrees of cold is much more nearly constant than with the corresponding instances where heat is employed, nor is there the same amount of difference in the curves for the various degrees of cold as for those of heat. This would seem to be contrary to the observed effects of cold and heat upon the judgments of weight and superficial area. It may be that it has its explanation in fatigue of the end organ, although every care was exercised to prevent such a result. It may be, too, that the hottest stimulus was nearer the pain limit than the coldest one and that the disparity springs in part from such a source. This, however, was not felt to be the case, and it would in any event hardly serve to explain the facts as regards the two middle temperatures used.

Table II. shows typical cases of the reduction in the amount of the average error resulting from practice. In only one in-

stance was there a failure to reduce the amount of the error, which remained to the end an error of underestimation. The subject for the pressure tests, it will be remembered, gave overestimates at the outset for the short lines. This overestimation disappeared under practice and became an underestimation, while in general the average amount of original underestimations was very slightly altered, sometimes in one direction, sometimes in the other. The total effect of practice seems for both subjects, therefore, to be in the direction of fixing as permanent a small underestimation. It may be well to emphasize in this connection that neither subject was at any time during the experimentation informed of the correctness or incorrectness of the judgments made. Consequently, the practice effects represent as purely as possible the results of trained attention and discrimination.

We may say in *summary*, therefore, (1) that in comparing dermal linear extents under conditions of passive pressure with optical linear extents the temperature of the dermal stimulus is of distinct importance; (2) the normal underestimation of such stimuli is diminished by the introduction of temperature, and (3) with stimuli which are distinctly hot or cold the underestimation is changed to overestimation; (4) our experiments warrant no attempt to connect in detail the amount of such changes in the estimates with the amount of change in the stimulus.

The actual process by which the judgments were made varied somewhat with the two subjects, although the increasing ease, rapidity and immediacy of the act was, as time went on, very marked.

One subject began with the mediation of a motor image of measuring the cutaneous line with the joint of the thumb. This motor image was then identified with a visual line. The judgment was slow and difficult at the outset. At length the process became easier and the motor imagery dropped out altogether. As soon as the stimulus was given, the eye ran rapidly over the lines until one was found, which was immediately and unhesitatingly picked out as correct. None of the surrounding lines seemed to be at all satisfactory and there was seldom any

doubt. The arm was never visualized by this subject, nor did visual imagery seen to play any part in the process. The normal judgments were on the whole more accurate and constant than those of the other subject.

The second subject employed visualization to a great degree. When the cutaneous stimulus was applied, a visual image of the part touched at once arose and from this as a basis the judgment was formed. In both cases, then, it would seem that the errors met with involve, and in part rest upon, the intermediary imagery connecting the cutaneous linear experiences with those of vision. Naturally, as practice increases, the various cutaneous stimuli come through the ordinary process of association to serve as symbols of certain visual extents. When the connection becomes firmly established, the original intermediary imagery is likely to disappear from consciousness and the judgments become essentially immediate.

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STUDIES FROM THE PSYCHOLOGICAL LABORATORY OF THE UNIVERSITY OF CHICAGO.

CONCERNING THE SIGNIFICANCE OF INTENSITY OF LIGHT IN VISUAL ESTIMATES OF DEPTH.

BY M. L. ASHLEY.

The following experiments were made with a view to testing a hypothesis in regard to the influence of intensity of light in judgments concerning the third dimension.

It was believed that, while convergence, accommodation,[1]

[1] A very full bibliography on the subject of visual space perception is given in Helmholtz's 'Physiologische Optik.' Among the many recent experimental investigations of convergence and accommodation may be mentioned:

Bourdon, 'Expériences sur la perception visuelle de la profondeur.' *Revue Philosophique*, 43, p. 29.

Arrer, 'Ueber die Bedeutung der Convergenz- und Accommodationsbewegungen für die Tiefenwahrnehmung.' *Philosophische Studien*, Bd. XIII., S. 116, 222.

Hillebrand, 'Das Verhältniss von Accommodation und Convergenz zur Tiefenlocalization.' *Zeitschrift für Psychologie und Physiologie der Sinnesorgane*, Bd. VII., S. 97.

E. T. Dixon, 'On the Relation of Accommodation and Convergence to our Sense of Depth.' *Mind*, N. S., Vol. IV., p. 195.

W. Wundt, 'Zur Theorie der räumlichen Gesichtswahrnehmungen.' *Philosophische Studien*, Bd. XIV., S. 1.

The interest in these discussions, especially the first three, was, of course,

size of the so-called retinal image, aërial perspective,[1] disparateness of retinal images, shadow, together with comparison with other objects, and similar secondary means of judging, had generally been acknowledged as factors influencing our estimates of the distances of objects, there still remained another factor, light,[2] or brightness, which was entitled to more recognition than it had yet received.

Convergence, accommodation and the other factors mentioned above as entering into judgments of depth become such factors or signs of depth, because they are impressions entering into or involved in the perception of distant objects and, under ordinary conditions, vary in some regular way as the distances of the objects vary.

These various factors do not have equal values under all circumstances as signs of distance. Some, such as convergence and accommodation, are almost always concerned in our estimates of depth, within certain limits, but lose their effectiveness for objects beyond those limits. Others, such as disparateness of retinal images, aërial perspective, shadow, size of retinal image and comparison with other objects, often give us little or no aid.

Changes in distinctness of outline and in color also accompany changes in distance, but while they are usually connected

convergence and accommodation. Bourdon mentions, however (p. 41), that in some instances a lantern or bright object was judged nearer when brighter. Arrer also speaks of the influence of light, for he says (p. 245) that changing illumination seemed to have an influence in judging the distance of a thread which was used as object.

[1] When, in speaking of the influence of aërial perspective, Helmholtz says ('Physiologische Optik,' 2 Aufl., S. 774) that in the case of a snow-capped mountain glistening in the sunshine we are likely to underestimate its distance, he cites an instance in which there may be another cause concerned in producing the illusion, viz.: the increased amount of light reflected from the snow-topped mountain. In cases of aërial perspective there is also more or less change of color involved, but while distinctness of outline and shade of color depend in a measure on intensity of light, they are to be distinguished from it.

[2] In Hermann's 'Lehrbuch der Physiologie,' p. 607, there is a statement in which direct reference is made to light itself. After mentioning other means of estimating distance the writer says: "Indirecte Entfernungschätzungen finden ferner statt aus den relativen Verschiebungen der Gegenstände bei Bewegung des Kopfes, ferner aus der in der Entfernung abnehmenden Lichtstärke."

with variation in illumination, they are to be distinguished from it psychologically as means of judging the distance of objects. It is clear that the farther distant an object is the less light we receive from it, either directly, or indirectly by reflection; and, aside from surrounding objects, which may exclude some light from its surface or reflect more upon it, the intensity or amount of light reaching a given portion of the retina would vary inversely as the square of the distance of the object. It was believed that if monocular vision were used, in order to exclude as far as possible all advantage arising from the use of two eyes instead of one, and the retinal image kept constant, it would be found very difficult to estimate the distance of an object provided the amount of light received from it were kept constant; or, if retinal image and actual distance were constant, that the distance could be made to appear to vary by increasing or decreasing the intensity of the light.

At first monocular vision was tried with somewhat varied objects. After quite uniformly favorable results had been attained with one eye, both were tried, and it was found that convergence and whatever other advantages both eyes possessed failed to prevent marked cases of illusion, even within limits where convergence was supposed to be most effective.

The monocular experiments will be described first.

I.

Monocular Experiments.

In order to keep the retinal image constant while the distance varied, a tube was constructed through which the observer looked at an upright sheet of paper. At whatever distance the paper was placed, the observer saw a round object which seemed to remain constant in size. A Welsbach lamp was placed directly behind the paper. The observer, being ignorant of the location of the light, saw only a round luminous object. Different papers were used, some of which showed marked irregularities as the light became stronger, but became more homogeneous as the light became fainter. One of the objects was a blue gelatine paper covered on

the back with a yellowish colored paper. This gave an almost perfectly homogeneous surface. Another paper was covered with fine dots and marks, which came into view when the light became strong and faded away as the light diminished.

The Welsbach lamp was altered so that the gas supply could be better regulated, and was furnished with an index which showed the intensity of the light in units of one candle-power. Fig. 1 shows the arrangement of the apparatus.

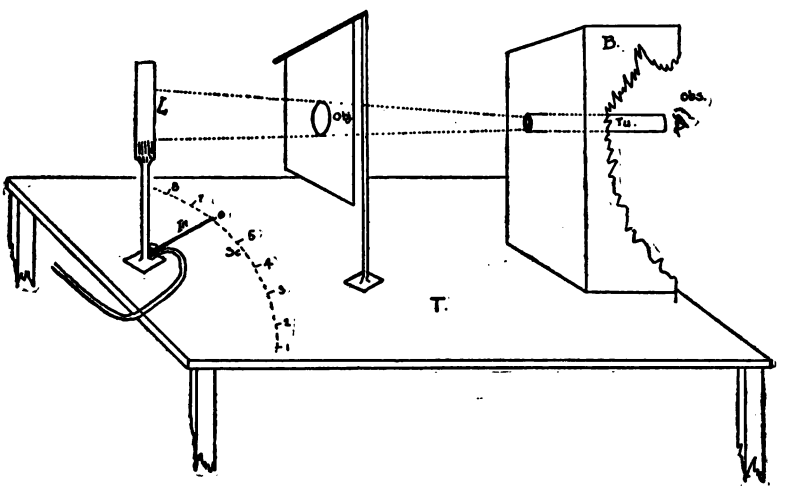

FIG. 1.

Obs represents the position of the eye of the observer, who looks through the tube, *Tu*, at the object, *Obj*, suspended between him and the lamp, *L*. *In* is an index and *Sc* a scale which measures the intensity of the light. The tube, *Tu*, has a large chamber between its two ends which prevents glimmering from its sides. The box, *B*, into which the tube, *Tu*, is fitted is blackened inside. A focussing-cloth covers the observer's head to exclude light as far as possible. The apparatus is arranged upon the table *T*.

Subjects A, B and C.

A, B and C looked at the same object in the same position, viz: a coarse, white paper suspended between the observer and the lamp, twenty inches from the lamp and six inches from the sub-

ject. The light was gradually increased, while the observer watched the luminous disk. The judgments were given in sets of ten each, starting with the lamp at one, three and seven candle-power respectively. Subject A gave seven sittings to the experiment, thus giving two hundred and ten judgments in all. With increased intensity of light he judged the object nearer in every instance but one, in which case he thought the distance unchanged.

It was found, upon taking an average of the ten judgments given each day from each of the three points of reference, that if one candle-power was made a starting-point the object was judged nearer, when 3.05, 2.05, 2, 2.15, 2, 2.45 and 1.84 candle-power was reached on successive days respectively. When three candle-power was taken as a point of reference, the ratio of increase required for similar results was 2.7, 2.03, 2.13, 2.15, 2.23, 2.11, and 1.98 on successive days; and when ten candle-power was taken to begin with, the ratio of increase reached 2.42, 1.9, 1.73, 1.8, 1.77, 1.71, and 1.74 on successive days. Upon being asked to report changes in brightness, he announced these when the light had increased about half as much as was required to make the object seem nearer.

On the first day B judged the object nearer in each case but one. The next day a few were judged 'the same' when three candle-power was taken as a point of reference, and nearly all were judged 'the same' when the start was made from seven candle-power. On the last day the object was judged to be the same distance as the point of reference in nearly every instance. In instances where he judged the object nearer, the change in candle-power was approximately the same as with A. On the first day B said that the object seemed to expand as it came up. On the second day he gave his judgments more deliberately and remarked that if he waited a short time it seemed to approach instead of merely growing brighter. The following days he said he tried to see whether it really did move or not, but could not see any actual motion.

Like subject B, C judged nearly every case 'nearer' the first day, fewer 'nearer' the second day, and nearly all 'the same' on the last day.

He remarked that there was often a conflict between his feeling and his judgment. He felt at first as if the object approached and there was a strong impulse to say 'nearer,' but after waiting the change seemed to be only in brightness. He said that if he did not reflect, he would judge it coming nearer in every instance. His judgments depended, he said, on whether he could make himself believe it was all due to light.

Subject D.

Subject D looked at a paper covered with fine dots and lines which came into view under increasing light and thus gave the object even more appearance of approaching.

The paper was arranged as in the preceding experiments, with the exception of being fifteen inches from the lamp and eleven inches from the observer. The first two or three days paper without the dots and lines was used. D did not judge readily that this approached. On the following days, especially when the dotted paper was used, he judged it nearer almost every time, the amount of required change in light being approximately the same as with the white paper used with former subjects. A number of times the light was diminished instead of increased, and then he judged the object to be receding, after the light had decreased in about the same ratio that it had to increase in order to bring about a judgment of 'nearer.'

Subject E.

After trying different papers, it was found that E gave the most uniform results when the homogeneous gelatine paper, already referred to, was used. The gelatine paper was placed eight inches from the lamp and about eighteen inches from the subject. Both sudden and gradual changes were tried. When the change was sudden, he was given a view of the object as it appeared at a certain degree of illumination; then the tube was suddenly closed by a lid, while the light was increased or diminished. He then looked again and judged what change, if any, there was in the distance of the object. The time consumed in making the change was three or four seconds.

It was found after three or four days' trial—the customary three sets of ten judgments each having been taken every day—that beginning with one candle-power the change in illumination must reach about two candle-power before he could be sure the object was nearer. If the start was made from two candle-power, the change must be to about four and one-half. If three candle-power was taken as a point of reference, then the change must reach about seven candle-power in order to be judged nearer. On the last day gradual changes, similar to those employed with the other subjects, were used, with no marked change in the results. In two or three cases E judged that the object receded. He said that sometimes the object seemed covered at first with a film; then the film disappeared and the object approached. When the light was diminished instead of increased, he thought the object receded. An occasional experiment of this latter sort was made to determine whether the subject would be consistent, when the direction of the change in light was reversed.

General Results of Monocular Experiments.

Besides the subjects whose judgments are referred to above, two or three others were tried whose judgments were too irregular to be of value in determining any very definite relation between variation in intensity of light and apparent change in distance. For the most part, however, they agreed with the others in judging the object nearer when brighter and farther when dimmer.

Besides these last-mentioned persons, ten or a dozen others gave one sitting to the experiment, the purpose being to see how they would be impressed, rather than to obtain any numerical results. They were shown various different colored papers at various degrees of illumination. Each one tended strongly to judge the object nearer when brighter and farther when its brightness diminished. Occasionally an opposite judgment would be given and occasionally the distance would be thought the same, but on the whole the results were quite regular.

Sometimes the paper would be moved toward the lamp and away from the observer, who would then think it approaching.

If moved toward him and away from the lamp, so as to decrease in brightness, he would say it was going away.

The observers did not know the arrangement of the apparatus and did not know they were judging wrongly. They were not told that the paper moved when it was kept stationary, but were asked whether it moved or not and in which direction. Sometimes when the paper was actually moved, they were told that it moved, but then were deceived in respect to the direction of the movement—thinking it moved away when it came nearer, and *vice versa*. From many remarks made by observers it was clear that the change in brightness was noted, in general, much before a distance change was felt.

When the distances of paper and lamp from the subject are constant, accommodation should remain constant. In monocular vision disparateness of retinal images would be avoided. Convergence would also be avoided as far as possible, and consequently judgments of 'nearer' and 'farther' could not well be due to anything else besides changing illumination, with whatever change there might be in distinctness, color and seeming change in size. In the case of the white papers, especially, the change in color would be little more than change in brightness, and with the white papers and the gelatine the outline of the circular object could be clearly seen, except at quite faint illumination. Whatever small irregularities came into view on the surface under stronger illumination would tend to give the impression of an object coming sufficiently near for its surface to be more clearly seen. In the case of the gelatine paper the main change was in color, from dark to a light purple, the surface being almost perfectly homogeneous.

The change in size, which was noticed by certain subjects, might be due in part to stimulation of a larger tract of the retina by the stronger light; in part it could be attributed to illusion caused by thinking the object approaching. Some of the observers said the object appeared to approach and then stop. This might be due to the fact that changes in accommodation and retinal image did not follow the supposed approach. The seeming check in approach may be explained, also, as due to a break in the act of accommodation. It is very

likely that in all judgments of distance under changing illumination such associated changes in accommodation may participate as factors. The iris is accumstomed to contract as accommodation for near objects takes place, and, as it contracts with increasing illumination, accommodation may follow. Supposing this to occur, this element would probably be most effective when changes were gradual instead of successive, and would be significant only within narrow limits, for the blurring of the object, which results from improper accommodation, would check the accommodation movement.

The film mentioned by one subject was, perhaps, due to improper accommodation at the starting-point, or to the object growing more distinct under increasing light.

It was found that, starting at as low a degree of light as would enable the paper to be seen fairly clearly, the ratio of increase must be about two—*i. e.*, the intensity must increase to about twice that of the point of reference—before the object would be judged nearer. If the light was decreased there would be a judgment of 'farther' given, when it had reached about half its former intensity.

II.

Binocular Experiments.

The binocular experiments may be classed under three heads, the third having four varieties.

1. In the first binocular observations the arrangement of apparatus was the same as shown in Fig. 1 with the exception of the tube. Instead of a tube, the observer looked through horizontal slits on opposite sides of the box, the slits corresponding to the ends of the tube. The slits were large enough to avoid getting double images within the distances used. The subject looked at a bright surface with both eyes instead of one, as in preceding experiments. As in the monocular experiments, various sorts of papers were used—white, colored, speckled and homogeneous gelatine paper.

Subjects A, B, C, D and E each gave a trial to the binocular experiments. The results with subjects B, C, D and E were not

materially different from those obtained from them in monocular vision. A's results, of which alone brief mention will be made, were very regular and corresponded closely to those he gave before in monocular vision. The discrimination was even finer than in monocular vision, the averages showing a ratio of change in intensity of light of 1.67, 1.63, 1.37 as the starting-point was taken at one, three or seven candle-power respectively. The same sort of paper was used as in A's monocular observations, the only difference being that the paper was seven inches farther from the lamp and seven inches nearer the subject than before. The paper was, of course, stationary. A was quite certain it approached in each instance, and remarked, "It comes right up to a fellow!"

Subject G.

Another subject, G, also gave very regular results. The paper used was covered with fine dots and was placed fifteen inches from the lamp and eleven inches from the observer. At the first sitting one judgment was given in which the object was thought farther. In all other instances he judged the object nearer with increasing light and farther when the light decreased, the average ratio of change in intensity of light being about 2 in either case.

Again, with subject G actual movement of paper was tried with constant light. He judged slight movements correctly. Then, when movement toward him was combined with decrease of light, he judged the object farther. When the paper was moved away from him with increasing light, he judged it approaching.

2. In the next form of binocular experiment the lamp was placed at the side of the box instead of in front of it. As object an upright stick, about the size of a lead-pencil, was placed in the line of vision of the two slits in the box. The arrangement is shown by means of Fig. 2.

Fig. 2 represents a box in which are two slits, through which the observer, *Obs*, looked at the object, *Obj*, from which light is reflected from the lamp, *L*. *Bg* is a black background, about four feet beyond the object.

The object was moved back and forth on the table from twenty to forty inches from the observer. As in the other experiments, the subject's head was covered with a focussing cloth.

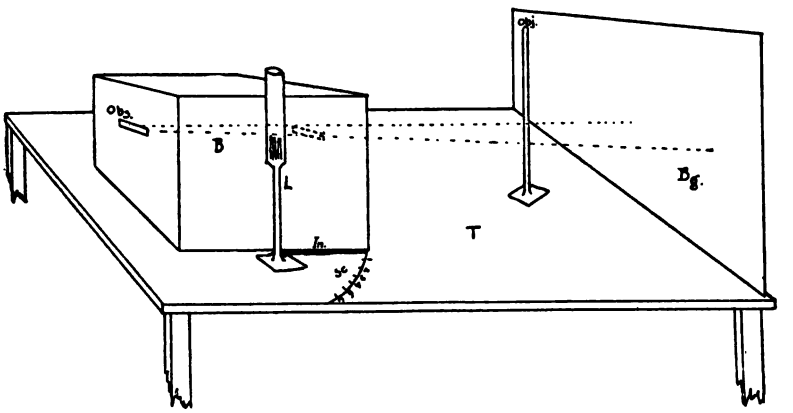

FIG. 2.

Three or four subjects looked at the object arranged in this way. One was rather uncertain when the intensity of the light was changed, sometimes thinking the object farther, sometimes nearer. Fairly definite results were obtained from two others. They judged correctly as to actual movement, but were deceived when the light was either diminished or increased. If the light was constant they could judge correctly after a movement of one and one-half inches.[1] If the light was increased in a marked degree while the object receded, they would judge it nearer; if, on the other hand, the object was moved nearer while the light was diminished, they judged it farther away. The actual movement in these cases of illusion was approximately the same as was required for correct judgments when the light was constant.

An objectionable feature in this form of experiment was that the background as well as the object grew light or dark, as the case might be. It would be unnatural for the whole field of view to become lighter when some single object approached.

[1] Wundt has found that at short distances a change $\frac{1}{51}$ of the actual distance is sufficient to enable one to discriminate a change in distance. The greater change required here is probably due largely to lower degree of illumination.

Accordingly, plans were devised to keep the background at a fairly constant degree of illumination while the object itself changed in brightness. The demand for a uniformly illuminated background led to the third form of binocular experiment, in which two sources of light were used—one to give to the background a fairly constant illumination, and the other to throw light of varying intensity on the object. Four varieties of this third form were tried, differing in the nature of the background. The varieties are classed as a, b, c and d.

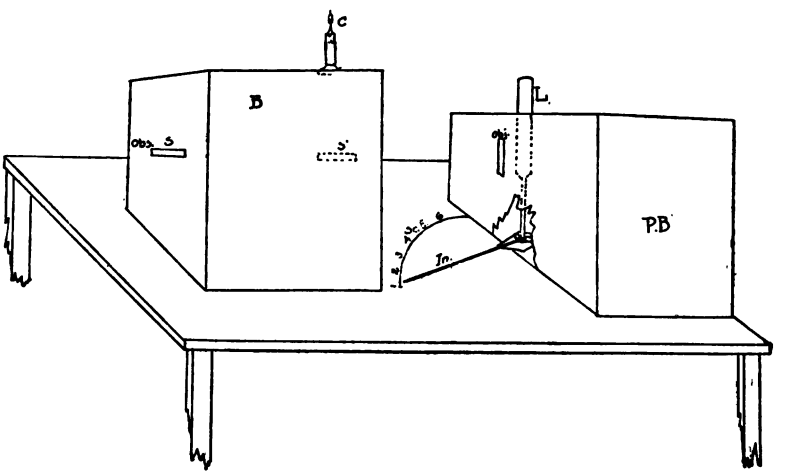

FIG. 3.

3 a. In the first variety of the third form the apparatus was arranged as shown in Fig. 3. *B* represents a box with slits, *S* and *S'*, as in the preceding diagram. *PB* is a pasteboard box enclosing the lamp, *L*, and serving as a background. Within this field is the object, *Obj*. The object is made by cutting an upright slit in the pasteboard box and covering it with transparent paper, in such a manner that the paper bulges outward over half an inch and, with little or no illumination from within, looks to the observer like an upright stick an inch in diameter, standing directly in front of the background, which is painted black. The upright object has a yellowish-white appearance. A candle, *C*, gives a constant illumination to

the background. *Sc* is a scale by which the intensity of the lamp can be graded. The object in these experiments was forty-four inches from the observer.

When the observer first sees the upright object, it is illuminated, together with the background, by the candle *C*. Then, when the light within the pasteboard box is increased, the object becomes lighter and seems to approach and separate from the background, which appears to recede and becomes indefinite as to position, or else attention is fixed on the object and the background forgotten.

This arrangement of apparatus was found very effective in producing illusions of movement. Four persons, H, I, J and K, each gave a number of sittings to this form of experiment. In nearly every instance each person judged the object nearer when its luminosity increased and farther when it decreased. Starting-points of .25, .5, .75 and 1 candle-power were taken and the ratio of change required to give an illusion of approach found to vary from 1.5 to 3. When the lower intensities were taken as starting-points, the required ratio of increase was less. The results from the four subjects did not differ materially.

In general, the subjects distinguished between changes of brightness and what appeared like a change in distance. If asked to notice when the object grew brighter and when it seemed to approach, they generally reported the alteration in brightness when the change had reached about half that required for the impression of 'nearer,' which they gave a little afterwards. Besides these subjects, four others gave one sitting to the experiment and were similarly impressed.

3 b. In the next variety of experiment, in which two sources of light were used, the lamp giving the variable light was placed below and in front of the box, while the candle, now enclosed in a paper shade, remained on top of the box. The lamp was enclosed in a pasteboard box in which was a small opening, which allowed a beam of light to fall on the object, but at such an angle that it did not strike the background within the field of view. By this means the background illuminated by the candle would remain practically constant in brightness, while the object could be made brighter at will. The background

was too far away and too dim for any shadow from the object to be seen.

Fig. 4 shows the construction of the apparatus. *B* is a box with slits *S* and *S'*, through which the observer *Obs* looks and includes in his field of vision the background within in *V*—*V'*. The background is formed by a dead-black curtain. The background is farther from the observer and *V*—*V'* larger than would appear from the diagram, but the portion of the background *O* illuminated by the beam of light from the lamp *L*

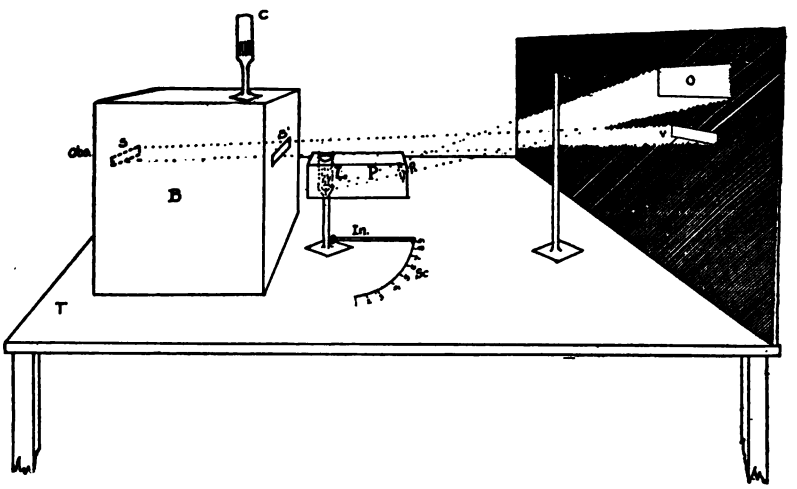

FIG. 4.

falls above *V*—*V'*. *P* is a small pasteboard box enclosing the lamp *L*, provided with a slit *R*, through which a beam of light passes, striking the object *Obj* in the observer's line of vision. *Sc* is a scale to regulate intensity of light by means of index *In*. *C* is a candle with shade, and *T* the table on which the apparatus is arranged.

With this apparatus various results were obtained. Out of eight persons who gave a few sittings to this variety of experiment, two seemed to be able to distinguish light changes from distance changes and were not much inclined to think the distance varied with change of illumination. One was rather irregular, judging sometimes one way, sometimes another, but

was inclined to judge the object nearer when bright. Another subject L distinguished to a certain extent between brightness and distance, in that brightness was clearly noted first, and then as it kept increasing the object was felt to come nearer. Sometimes, however, there was little or no impression of a change in distance.

The light of the candle giving constant illuminaton to the background was low, the shade decreasing it to not more than a tenth of one candle-power. The upright used in this variety of experiment was a round stick one-half inch in diameter, covered with whitish paper on which were fine dots and lines. The object was forty inches from the observer.

When the lamp was gradually increased from zero candle-power, subject L noted a change in brightness of the object at .5 candle-power, and, when 2 candle-power was reached, thought it approached. If .5 candle-power was taken as a starting-point, brightness and approach were noted at 2 and 5 candle-power respectively.

Subject M.

M was rather irregular. When the object was stationary and only the light changed, there was no marked tendency to judge the object nearer or farther. When the lamp was turned so low as to be negligible, an increase of six inches in distance could be detected fairly well starting from forty inches, the changes being made while the view of the object was shut off by covering slit S' with a piece of cardboard.

A combination of changes was now tried during which the following judgments were given.[1] Column L marks the increase in candle-power starting at zero. Column D marks the distance in inches that the object was moved from the point of reference and away from the subject. At the reference point the object was forty inches away and the lamp at zero candle-power in each case. In column J, giving judgments, s means 'the same,' and f indicates 'farther.' M was given a view of the object as a point of reference. Then, after the slit S' was closed,

[1] The following experiments were of such a nature that the results can be shown best in tabulated form.

changes were made in the light and in the distance of the object. S' was now opened and the subject asked to judge whether the object was the same, nearer or farther.

M's Results.

L	D	J	L	D	J
2	4	s	2	8	s
2	6	s	2	9	f
2	7	s	2	8	f
2	8	f	2	8	s
2	8	f	2	9	s
2	6	f	2	9	f
2	5	s	2	10	Doubtful
2	6	s	2	11	f

The increase of light seems here to have had little more than a disturbing influence. At least, there is no very marked tendency to let increased brightness compensate for an actual change in distance.

Subject N.

In the case of subject N the influence of light, both alone and in combination with actual movement of the object, was much more pronounced.

When the lamp was turned down, N could detect an actual movement nearer of three inches, and a movement away of five inches. The reference point was forty inches away in all instances. When the object was stationary and forty inches distant he generally judged it nearer when the lamp reached two and one-half candle-power; or, starting from this point, he would judge the object farther when the light from the lamp was decreased to zero.

The table below shows the results of combining change of light with change of distance. As with subject M, in every instance a point of reference was given and then the adjustments were made while slit S' was closed.

Column L shows increase of lamp-light in candle-power; D, increase of distance in inches; J, judgments of same, nearer and farther.

Other judgments were taken in which the object was moved nearer while the light was decreased, starting from two candle-

power. In these instances an actual movement of four or five inches nearer would be often judged 'the same.' Also actual movements away of ten inches were judged 'the same' when the lamp meanwhile increased from zero to eight candle-power.

N's Results.

L	D	J	L	D	J	L	D	J	L	D	J
2	4	s	2	9	f	2	4	s	4	5	n
2	6	s	2	9	f	.75	5	f	3	5	s
2	8	n	2	8	f	1	5	s	3	5	f
2	10	f	2	8	s	2	5	n	5+	5	n
2	9	f	2	7	s	3	5	f	5	5	n
2	7	s	2	6	f	3	5	n	5	5	n
2	8	s	2	6	s	3	5	s	5	5	n
2	8	f	2	5	s	4	5	n	5	5	n
2	9	f									

It will be clear from the tables that in one set of judgments the increase in light was the same each time, while the distance increase varied with an accompanying variation in judgment. In the other set distance change was constant, while the light increased. In the first set an increase of two candle-power seemed to compensate for an increase in distance of about three inches. In the second set five inches increase in distance seemed to be more than offset by an increase of five candle-power in lamp-light.

Subject O.

Subject O judged on the whole much as N had done. Conditions were same as with N, viz.: reference point at forty inches, constant light from shaded candle, variable light from the lamp and same object.

With the lamp at zero an increase of three inches or decrease of two inches in distance would generally be correctly judged. If the distance remained constant, an increase of lamp-light to two candle-power would be called 'brighter and nearer.' A change from two candle-power to zero would be judged farther. Combinations were now tried, some results of which are given in the table below. In the first set recorded here the background was the one that had been used throughout this form of binocular experiment. In the second set a whitish background was sub-

stituted for it and placed nearer, being located forty inches beyond the object.

O's Results.

First Set.						Second Set.					
L	D	J	L	D	J	L	D	J	L	D	J
2–0	1n	d & f	0–2	0	b & n	2–0	3n	f	0–2	3f	n
2–0	2n	d & f	0–2	2f	b & n	2–0	5n	f	0–2	4f	n
2–0	3n	d & f	0–2	3f	b & s	2–0	7n	f	0–2	5f	n
2–0	4n	d & s	0–2	4f	b & s	2–0	8n	f	0–2	6f	n
2–0	5n	d & s	0–2	5f	b & f	2–0	9n	f	0–2	7f	n
2–0	6n	d & n	0–2	6f	b & f	2–0	9.5n	s	0–2	7f	n
2–0	7.5n	d & n	0–2	7f	b & f	2–0	10n	s	0–2	8f	n
2–0	8n	d & n	0–2	8f	b & f	2–0	12n	n	0–2	9f	n
2–0	9n	d & n				2–0	10n	n	0–2	10f	s
						2–0	12n	n	0–2	11f	s
									0–2	12f	s
									0–2	14f	f
									0–2	18f	f
									0–2	20f	f

In columns marked L changes in the lamp-light from zero to two, or from two to zero, are recorded. Columns marked D show the increase or decrease of distance in inches that were combined with these changes in the light; n stands for nearer and f for farther. In columns marked J, n, f, b and d mean that the object was judged nearer, farther, brighter or dimmer, as the case might be.

In the first set it appears that with light-change from two to zero an approach of six inches was required before the object was judged nearer. In the second set double this actual movement was required for a similar judgment. In the first set a light-change from zero to two had to be combined with five inches' actual movement away to give an impression of farther, while in the second set from twelve to fourteen inches was necessary. In each set, when the turning-point was reached, where there was a transition from judgments of 'nearer' to those of 'farther' or *vice versa*, there was much perplexity on the part of the subject, who seemed to think there must be something wrong subjectively. It appeared that conflicting factors were felt, and, until one became strong enough clearly to outweigh the other, there was considerable difficulty in telling what had taken place in respect to movement. A similar thing may

also be said of subject N in the case of similar combinations. The white and nearer background seemed to be a disturbing rather than helpful factor.

3 c. In this variety of binocular experiment the apparatus was the same as described under 3 b, except that two objects were used, the farther of which remained the same as to light and distance, while the first varied in brightness. The first and variable object was the same one that had been used up to this point, and was located thirty-one inches from the subject. The other object was placed a little to one side of this first one and twenty inches farther away. It was expected to serve as background and supplementary means of judging whether the first moved or not.

The subject was given a view of them both at once and then, after the brightness of the first had been altered, was asked whether they were the same distance apart. When the lamp, which illuminated the first, was increased from zero to eight or ten candle-power, the objects were thought to be separated farther and the first or bright one generally seemed nearer the subject. A decrease of light from eight or ten candle-power to zero would give the impression that the objects had come closer together. Subject O gave judgments of this nature, and also another person who did not readily get impressions of distance change in the variety of experiment described under 3 b.

3 d. In this variety of experiment the apparatus was very similar to that used in 3 a. The modifications were a decrease in intensity of the candle used for constant light to about one-tenth candle-power, and a second object placed between the observers and the upright luminous object used in 3 a. This second object was the upright one used in 3 b. It was placed about two feet from the subject, so that it appeared to be much nearer the subject and a little to one side of the other luminous variable object, which was about fifty-six inches away. This arrangement showed two objects, one beyond the other and far enough to one side not to be confused with it. The subjects ooked at the two objects while the brightness of the farther one increased or diminished.

Subject O gave a few judgments in respect to the distances

of these objects. When one, *i. e.*, the nearer one, remained constant in brightness and distance, and the farther one varied in brightness, the farther one was often judged to approach. The results, however, were rather conflicting, the farther one sometimes seeming to approach or recede as it became brighter or dimmer, while the first one seemed stationary. At other times the first one seemed to check the tendency to judge the other approaching or receding.

Two other persons who made a few observations had similar impressions of distance change when the brightness of the farther object varied. This was especially the case when the objects were even farther apart. When nearer together, there did not seem to be so much impression of change in the distance of either.

General Results.

The various sorts of binocular experiments were devised to give varied and consequently greater evidence as to the influence of intensity of light as a factor in estimates of depth. It has been found, as a rule, of marked importance, even where accommodation, convergence, size of retinal image and disparateness of retinal images could enter to oppose it; and even within the short distances tried, where the other opposing factors would be thought most effective, it has been shown to be equivalent in some instances to a certain amount of actual distance change.

In the monocular experiments something very much like Weber's law was found in the relation of increase of light to apparent decrease in distance of the object. The distances used as points of reference have been small, but there is reason to suppose that at larger distances where accommodation, convergence and disparateness become of little or no value, the relative importance of light as a factor in distance judgments would increase.

As mentioned before, the subjects did not understand the arrangement of the apparatus, and throughout the experiments care was taken to avoid as far as possible the matter of suggestion. In both monocular and binocular experiments, sub-

jects have mentioned changes in distance without expecting to see distance changes and without having been asked whether they saw such changes. This is especially true of subject O, who gave very definite results in the combination under 3 b.

While there is room for far more extended investigation in respect to both larger distances and more definite numerical determinations, it appears that the hypothesis made at the beginning has received considerable evidence in its support.

In conclusion, I wish to acknowledge my indebtedness to Professor J. R. Angell for many helpful suggestions in respect to different phases of the investigation. My thanks are also due those who very kindly served as subjects in a work which for them was less interesting, because its real object was not understood.

Louis D. Brelwold

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THE IMAGINATION IN SPINOZA AND HUME

A COMPARATIVE STUDY IN THE LIGHT OF SOME RECENT CONTRIBUTIONS TO PSYCHOLOGY

BY
WILLARD CLARK GORE, PH.D.

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NOTE.

THE page references to Spinoza's writings refer either to the translation by Elwes, two volumes, London, 1891, or to the *Opera*, two volumes, edited by Van Vloten and Land, The Hague, 1882–83. When both are referred to, E. designates the translation, and L. the *Opera*. The page references to Hume's writings refer to the *Treatise of Human Nature*, edited by Selby-Bigge, Oxford, 1896.

A COMPARATIVE STUDY OF THE THEORIES OF THE IMAGINATION IN SPINOZA AND HUME.

THE object of this study is to make a specific test, or at least to find an illustration, of the general proposition that philosophy, or metaphysics, and psychology form a logical partnership, an organic unity, which cannot be ignored or dissolved without impairing interests that each holds to be peculiarly its own.

Such a proposition is liable to be greeted either as harmlessly commonplace, or as hopelessly behind the times, or as absurdly premature, according to the local conditions which it chances to encounter. Few would deny, I suppose, that philosophy and psychology are related members of one body of knowledge, and a good deal of philosophizing as to the organic nature of that relationship would doubtless be good-naturedly tolerated even by some who would be the first to resent the logical consequences of this kind of philosophizing. Again, there are those who, granting that philosophy, or "metaphysics," and psychology have been intimately associated in the past, perhaps not altogether to the detriment of the latter in some instances, would at the same time dwell upon the fact that psychology, following the example of the natural sciences, has long made good its escape from the leading-strings of its ancient mother. And, finally, there are those who would assert that a new and real unification of the two disciplines, a recognition of the partnership, would seem to be quite unwarrantable and premature, being without adequate scientific backing from any source, and thus affording a prospect so vague and remote as not to appear worthy of serious consideration.

It is not so much with the intention of verifying the proposition or hypothesis in question as it is with the hope of making it less vague and remote in some particulars, that this critical examination of a narrowly restricted portion of the field has been attempted, namely, the theories regarding the imagination which are found in the philosophies of Spinoza and of Hume. No especial reason need be given for choosing this particular subject-matter, save that it is concerned with psychological specimens which are found growing in philosophical soil; many

other topics would doubtless have served the purpose as well, if not better. The method employed — that of presenting contrasting theories for mutual criticism — is purely subordinate to the end in view, and is rather an after-thought than an essential condition, since it occurred to the writer only after Part I, which deals with Spinoza's theory of the imagination, had taken what is practically its present form.

PART I.

A STATEMENT OF SPINOZA'S THEORY OF THE IMAGINATION.

SPINOZA'S identification of the imagination with the source of all falsehood, error, and confusion—a doctrine which runs in varying forms through nearly all of his works, and which is so fully and consistently worked out, taking it as a whole, that it may fairly be called a theory of the imagination—is not to be intelligently stated or appreciated, it almost goes without saying, apart from the main body of his philosophy. What was the need, the problem, that this doctrine arose to meet? What did it contribute toward the attainment of the end proposed as a solution? In what respects, if any, does it appear inconsistent, or inadequate? and why? These questions openly confess to the assumptions that Spinoza was conscious of a problem, did propose a certain end as a solution, and developed a theory of the imagination as one of the means—not necessarily the only one—of attaining the end. It is believed, however, that these assumptions rest on Spinoza's own statements, especially on those in the autobiographical portion of that propædeutic to his philosophy, the *Tractatus de Intellectus Emendatione*.

SEC. I. THE NATURE OF SPINOZA'S PROBLEM.

Experience, we are told in the *Tractatus de Intellectus Emendatione*, had taught Spinoza that the commonly accepted goods of life are vain and futile; that the all-absorbing ideals commonly conceived to constitute the *summum bonum*—riches, fame, and the pleasures of sense—when realized are found to be uncertain and fleeting, followed by melancholy and a dulled intellect in the case of the pleasures of sense, and by perpetual dissatisfaction with successive attainment in the case of fame and riches.

The same problem is suggested elsewhere in Spinoza's writings. In that earliest of his writings—the *Dialogue between Understanding, Love, Reason, and Desire*, composed probably four or five years prior to his excommunication—there is a trace of the same kind of dissatisfaction. At the beginning of the dialogue Love questions the Understanding regarding the nature and existence of an absolutely perfect being; Understanding answers that such a being and the whole of

nature are one, and Reason is called upon to corroborate this intuitive assertion. Then Desire breaks in with an attempt to point out contradictions in the answers that Understanding and Reason have given; and advises Love to remain content with the things that he, Desire, has shown to her. Love turns on Desire with these bitter words:

> You shameless wretch! What things have you shown to me, save those from which would follow my ruin? For if I had ever allied myself to the things which you have shown me, from that hour I should have been pursued by the two arch-fiends of the human race — Hatred and Remorse — and now and then by Forgetfulness. Therefore I turn again to Reason. May he continue, and stop the mouths of those fiends. (Sigwart, German transl., p. 26.)

The same note is struck in the second part of the *Brevis Tractatus de Deo, Homine et Beatudine*, Chap. V, where we are told that we become weak and miserable through love of transient things. To be sure, there is a still harder fate possible for us; for Spinoza concludes this paragraph by saying:

> If those who love transient things, which have some degree of reality, are so miserable, how is it possible to conceive the misery of those who love fame, riches, and the pleasures of sense, which have no reality at all!

The essentially objective reference of the dissatisfaction is the important thing to note. Spinoza's pessimism is far from the pessimism of Schopenhauer. It is not a despair born of a sense of the all-devouring, yet perpetually hungry, character of the will itself. It is not a pessimism with reference to the nature of desire itself, but it is a pessimism, or — if that is too strong a word — a deep-seated dissatisfaction, with reference to the ordinary *objects* of desire.

> All the objects pursued by the multitude not only bring no remedy that tends to preserve our being, but even act as hindrances, causing the death not seldom of those who possess them, and always of those who are possessed by them.[1]

After mentioning examples of this fatal tendency, Spinoza concludes that:

> All these evils seem to have arisen from the fact that happiness or unhappiness is made wholly to depend on the quality of the object which we love. When a thing is not loved, no quarrels will arise concerning it — no sadness will be felt if it perishes — no envy if it is possessed by another — no fear, no hatred;

[1] "Illa autem omnia, quae vulgus sequitur, non tantum nullum conferunt remedium ad nostrum esse conservandum, sed etiam id impediunt, et frequenter sunt causa interitus eorum, qui ea possident, et semper causa interitus eorum, qui ab iis possidentur." (*Trac. de Intell. Em.*, p. 4.)

in short, no disturbances of the mind. All these arise from the love of what is perishable, such as the objects already mentioned.[1]

Let these brief statements, insignificant though they may appear in comparison with the great systematic developments of his thought, be given their due weight, and they will be found to afford some idea, it is believed, of Spinoza's fundamental problem, which was an ethical problem, perhaps *the* ethical problem, the problem as to the nature of the good. Scarcely more than the origin of this problem has been touched upon, its origin in the feeling of intense dissatisfaction with the fleeting and perishable objects, the barren ideals, which are pursued by the multitude, with the so-called goods of this life — riches, honor, and pleasure — with "the worldly hope men set their hearts upon," which —

> "Like snow upon the desert's dusty face,
> Lighting a little hour or two — is gone."

It does not appear, however, that this dissatisfaction had any sentimental or æsthetic interest for Spinoza. Rather was it a stimulus to a solution, to the discovery of a true and eternal good.

Postquam me experientia docuit, omnia, quae in communi vita frequenter occurrunt, vana et futilia esse: . . . . constitui tandem inquirere an aliquid daretur, quod verum bonum, et sui communicabile esset, et a quo solo, rejectis caeteris omnibus, animus afficeretur; imo an aliquid daretur, quo invento et acquisito, continua ac summa in aeternum fruerer laetitia. (*Trac. de Intell. Em.*, p. 3.)

To this positive interest in the problem we now pass.

SEC. II. THE END PROPOSED BY SPINOZA AS THE SOLUTION.

The end or ideal proposed by Spinoza as the solution, and virtually set over against the fleeting, partial goods pursued by the multitude, is that of a true good, a *verum bonum*, an eternal, infinite good, a fixed good (*fixum enim bonum quaerebam*), a good "having the power to communicate itself, which would affect the mind singly, to the exclusion of all else;" a good "the discovery and attainment of which would enable one to enjoy continuous, supreme, and unending happiness." But how is such a good to be obtained? Spinoza says that he made many efforts to arrive at this new principle, or at any rate at a

[1] "Videbantur porro ex eo haec orta esse mala, quod tota felicitas aut infelicitas in hoc solo sita est, videlicet, in qualitate objecti, cui adhaeremus amore. Nam propter illud, quod non amatur, nunquam orientur lites, nulla erit tristitia, si pereat, nulla invidia, si ab alio possideatur, nullus timor, nullum, odium, et, ut verbo dicam, nullae commotiones animi: quae quidem omnia contingunt in amore eorum, quae perire possunt, uti haec omnia, de quibus modo locuti sumus." (*Trac. de Intell. Em.*, p. 5.)

certainty concerning its existence, without changing the conduct and usual plan of his life, but in vain. Compromise was impossible. Either the ordinary pursuits and ideals of life must be abandoned, or else the quest for the *verum bonum*. He felt that he must choose between a possessed good uncertain and transient in its nature, and a good not uncertain in its nature (*fixum enim bonum quaerebam*), but uncertain in the possibility of its attainment.

Further reflection convinced me that, if I could really get to the root of the matter, I should be leaving certain evils for a certain good. I thus perceived that I was in a state of great peril, and I compelled myself to seek with all my strength for a remedy, however uncertain it might be; as a sick man struggling with a deadly disease, when he sees that death will surely be upon him unless a remedy be found, is compelled to seek such a remedy with all his strength, inasmuch as his whole hope lies therein.[1]

Spinoza's logical method, in the largest sense of the word, was conceived in this struggle. The fundamental significance of the logical method was, and is, that it emerged in the course of the struggle, and that it began at once to exercise a modifying influence upon the conflicting elements, transforming the end and discovering the means for its realization. The end is transformed by being stated in intellectual terms. The highest good ceases to be a mystic abstraction set over against the partial, concrete values of the life that now is. Spinoza was forced to recognize that human weakness cannot attain in its own thoughts to the eternal order and fixed laws of nature. At the same time he asserted that a man can conceive a human character much more stable (*multo firmiorem*) than his own, and that such a man sees no reason why he should not acquire such a character, and is led to seek for means which will bring him to this pitch of perfection, calling everything which will serve as such a means a true good.[2] The highest good is that a man should arrive, together with other individuals if possible, at the possession of this character.[3] And now comes Spinoza's statement of what this character is, a statement which, in virtue of its formulation in intellectual terms, opens the way to a

[1] "Assidua autem meditatione eo perveni, ut viderem, quod tum, modo possem penitus deliberare, mala certa pro bono certo omitterem. Videbam enim me in summo versari periculo, et me cogi, remedium, quamvis incertum, summis viribus quaerere; veluti aeger lethali morbo laborans, qui ubi mortem certam praevidet ni adhibeatur remedium, illud ipsum, quamvis incertum, summis viribus cogitur quaerere, nempe in eo tota ejus spes est sita." (*Trac. de Intell. Em.*, p. 4.)

[2] "Incitatur ad media quaerendum, quae ipsum ad talem ducant perfectionem: et omne illud, quod potest esse medium, ut eo perveniat, vocatur verum bonum." (*Ibid.*, p. 6.)

[3] "Summum autem bonum est eo pervenire, ut ille cum aliis individuis, si fieri potest, tali natura fruatur." (*Ibid.*)

logic, to an account of the means for attaining the end. This character, Spinoza says, is the knowledge of the union existing between the mind and the whole of nature.[1]

This, then, is the end for which I strive, to attain such a character myself, and to endeavor that many should attain to it with me. In other words, it is a part of my happiness to lend a helping hand, that many others may understand even as I do, so that their understanding and desire may entirely agree with my own.[2]

SEC. III. THE MEANS FOR ATTAINING THE END.

I shall not attempt to make a very systematic statement under this heading, for fear of forcing an interpretation of Spinoza's philosophy. One of the most significant features of that philosophy is that it does not differentiate to any considerable extent between logical, psychological, and ethical categories. Chiefly for the sake of convenience, then, as the field to be covered is exceedingly broad and diversified, I will partition it, with reference to the treatment of the imagination involved, into —

I. The *Tractatus de Intellectus Emendatione*, which works out a logical method ;

II. The *Tractatus Theologico-Politicus*, in which the theory of the imagination is effectively applied, and at the same time is much more fully developed ; and

III. The *Ethica*, where further developments of the theory of the imagination are to be noted, especially on the more distinctively psychological and ethical sides.

I. *Tractatus de Intellectus Emendatione.*

Spinoza first pointed out that, in order to attain the ideal character, which is a unity of self with the whole of nature, it is essential both to understand and to form a social order such as is most conducive to the attainment of this character by the greatest number with the least difficulty and danger. He then enumerates the following somewhat more specific measures: Moral philosophy, and the sciences of education, of medicine, and of mechanics. "But before all things," he continues, "a means must be devised for improving the understanding and purifying it, as far as may be at the outset, so that it may apprehend things without error, and in the best possible way." In other

[1] "Quaenam autem illa fit natura ostendemus suo loco, nimirum esse cognitionem unionis, quam mens cum tota Natura habet." (*Ibid.*)

[2] "Hic est itaque fines, ad quem tendo, talem scilicet naturam acquirere, et, ut multi mecum eam acquirant, conari; hoc est, de mea felicitate etiam est operam dare, ut alii multi idem atque ego intelligant, ut eorum intellectus et cupiditas prorsus cum meo intellectu et cupiditate conveniant." (*Ibid.*)

words, it is a logic that Spinoza seeks to develop as the first and fundamental means of controlling science and thus arriving at the ideal. To this task alone Spinoza addresses himself in the rest of the *Tractatus de Intellectus Emendatione*, and with it emerges his conscious logical method as distinguished from the larger logic of the situation, which I have attempted to follow up to this point.

What might fairly be called his logical theory falls into two main divisions. The first of these divisions corresponds pretty closely to the larger logic of the situation, which I have just referred to, and leans toward a genetic view of logical processes. The second is devoted to logic or method in the narrower sense of the term — that is, logic as a body of rules. I will try to state his position far enough to make it clear where the treatment of imagination enters and plays its part. Under the first division, Spinoza discriminates three stages: (1) The end, to which we wish to direct all our thoughts. ("Habuimus hujusque primo Finem, ad quem omnes nostras cogitationes dirigere studemus," p. 15.) (2) The mode of perception best adapted to attaining the end; corresponding, I believe, to what we should call the most effective attitude of mind. (3) The discovery of the best way to begin, namely, the use of every true idea as a standard. This corresponds in a way to what we should term the discovery of a working hypothesis, though for Spinoza there was absolutely nothing of a hypothetical character about the true idea.

I will state more fully what Spinoza means by the standard idea, because it is in connection with the methods of determining it that the treatment of the imagination emerges. The standard idea is its own test of truth, because it is an instrument created by the native strength of the intellect. There is no test of truth for the intellect extrinsic or back of itself. A *regressus ad infinitum* is out of the question. "In order to know, there is no need to know that we know, much less to know that we know that we know . . . . for, in order to know that I know, I must first know." Spinoza's famous hammer illustration comes in here: "It would be as foolish to argue that men have no power of working iron because they must use a hammer, which in turn must have been made by another hammer, and that by another or by other tools, and so on to infinity, as it would be to argue that the mind could not know truth as truth." And again: "The reality of true thought does not acknowledge the object as its cause, but must depend on the actual power and nature of the understanding." Furthermore, not only does a true idea necessarily first of all exist in us as a natural

instrument, "but it is absolutely correlative with its physical object;" this is, of course, a fundamental assumption with Spinoza.

Under the second division, Spinoza states his more specific principles of logic:

1. The means of distinguishing a true idea from all other perceptions.

2. Rules for perceiving unknown things according to the standard of the true idea. We might be led to suspect that Spinoza had anticipated what in principle corresponds to the technique of modern laboratory procedure, but he confined himself to a warning against "confounding what is only in the understanding with that which is in the thing itself," and to a discussion of the conditions to be met in framing a good definition.

3. An order which enables us to avoid useless labor (this corresponds to classification).

4. The perfection of method, which would be when we had attained to the idea of the absolutely perfect being. "This is an observation which should be made at the outset, in order that we may arrive at the knowledge of such a being more quickly."

The treatment of the imagination becomes immediately involved only in the discussion of the first of these four principles, namely, the means of distinguishing a true idea from all other perceptions.

Should the reader raise the question, "Why did Spinoza need to propose means of distinguishing a true idea from all other perceptions, after the true idea had been declared to be its own witness of its truth?" an answer will be found in what Spinoza has to say concerning the validity of reasoning about the test of truth itself. He admits that, if "by some happy chance" anyone had stumbled upon the true idea, "in his investigations of nature," that is, if he had acquired new ideas in the proper order, according to the standard of the original true idea, he would never have doubted the truth of his knowledge, "inasmuch as truth, as we have shown, makes itself manifest, and all things would flow, as it were, spontaneously toward him." But this rarely or never happens, Spinoza continues. This order of thinking, though "adopted by men in their inward meditations," is rarely employed in investigation of nature, because of current misconception, because it demands keen and accurate discernment, and, lastly, because "it is hindered by conditions of human life, which are, as we have already pointed out, extremely changeable." I have quoted this partly for the sake of showing in what form the original problem persists. It is

at this particular point that the treatment of the imagination becomes explicit.

There are three types of ideas which the mind, according to Spinoza, must be kept from confusing with true ideas. These three types are: fictitious, false, and doubtful ideas. All of these originate in the imagination, "that is, in certain sensations fortuitous (so to speak) and disconnected, arising, not from the power of the mind, but from external causes, according as the body, sleeping or waking, receives various motions."

Spinoza perceives that he has appeared to beg the question, and requests that no one be astonished that "before proving the existence of body and other necessary things he has spoken of the imagination of the body and of its composition." The view taken is immaterial, he continues, so long as we know that the imagination is something *indefinite*, that it is essentially *different* from the understanding, that the mind with regard to it is *passive*.

We can know "the true idea because it is simple or compounded of simple ideas," because it is clear and distinct. But a "fictitious idea" cannot be clear and distinct. It is necessarily confused, "because the mind has only a partial knowledge of the object, and does not distinguish between the known and the unknown, and because it directs its attention promiscuously to all parts of the object at once without making distinctions." "Fiction never creates or furnishes the mind with anything new; only such things as are already in the brain or imagination are recalled to the memory, when the attention is directed to them confusedly and all at once." The mind in imagination is at the mercy of its world. Chance associations rule. 'For instance, we have remembrance of spoken words and of a tree; when the mind directs itself to them confusedly, it forms the notion of a tree speaking." Again, we can know a true idea because it shows how and why something is or has been made. Imagination introduces the irrelevant. "If an architect conceives a building properly constructed, though such a building may never have existed, and may never exist, nevertheless the idea is true; and the idea remains true the same whether it be put into execution or not." But imagination asserts, not the essence, but the existence, of a building — to adapt Spinoza's illustration — without knowing whether the building really exists or not. So the true idea of a sphere is the concept of its construction by means of the revolution of a semicircle on the diameter. But imagination affirms something not contained in such a concept, as

motion or rest of the semicircle apart from the relation of a semicircle to the production of a sphere.

When the imagination and the understanding, or the perception of true ideas, appear to be associated, the danger is especially great, giving rise to complete deception. This occurs when certain things presented to the imagination also exist in the understanding. Then true and false ideas become confused. Spinoza instances the Stoics, who "heard that the soul is immortal, yet imagined it only confusedly; they imagined, also, and understood that very subtle bodies penetrate all others, and are penetrated by none. By combining these ideas, and being at the same time certain of the truth of the axiom, they forthwith became convinced that the mind consists of very subtle bodies; that these very subtle bodies cannot be divided, etc. But we are freed from mistakes of this kind, so long as we endeavor to examine all our perceptions by the standard of a given true idea." In another, though similar, way we confuse the intellect and the imagination. We think that what we more readily imagine is clearer to us; that what we imagine, that we understand. Thus we violate the true deductive method, "the true order of progression"—putting first what should be last.

There are other grave errors arising through not distinguishing accurately between the imagination and the understanding: such as "believing that extension must be localized; that it must be finite; that its parts are really distinct one from the other; that it is the primary and single foundation of all things; that it occupies more space at one time than any other; and other similar doctrines, all entirely opposed to the truth, as we shall duly show."

Finally, an idea is stated, though not developed very far, in this *tractatus*, which is one of the fundamental ideas of the Spinozistic philosophy. The imagination is affected only by "particular, physical objects, and thus perceives things in a determinate number, duration, and quantity;" whereas the understanding perceives things not so much under "the condition of duration as under a certain form of eternity and in an infinite number."

To put the substance of the matter in a sentence or two: The theory of the imagination furnishes a negative test of the standard idea. Let no trace of the imagination be found in it. Let no influence from any external and particular object or time contaminate it. Let no confusion enter into it from without through the gates of sleeping-awake—for error is the dreaming of a waking man. "Error autem est vigilando sominare." Let the standard idea be the instru-

ment created solely "per vim nativam" of the mind itself working according to fixed and eternal laws, the fulfilment of which is freedom.

Assuming that we now have before us a fairly complete statement of the theory of the imagination as it is worked out in the *Tractatus de Intellectus Emendatione*, the true critical question that arises is: To what extent will it be found a useful means in attaining the end proposed, in solving the original problem? Recall the nature of that problem—the fleeting, perishable, finite character of the commonly accepted goods of this life; the sham, the self-deception of it all. What has Spinoza done save to identify this problem with the nature of the imagination, and then by rejecting the imagination to get rid of the problem—a solution by exclusion, by excommunication? Infinitely more! it will be said. Has he not pointed out the way to the goal—the formation of that perfect character which is the knowledge of the unity of itself with the whole of nature—by showing how the individual himself, any individual who thinks, is by virtue of the very act of thought a creator of the instruments of truth with which to attain the goal? True, all this may have been won for the individual—but only at the cost of the essence of individuality itself. All spontaneity, all initiative, all variability, all progress is ruled out. "For the soul," Spinoza says, "acts according to fixed laws and is, as it were, an immaterial automaton."[1]

II. *The Tractatus Theologico-Politicus.*

The object of the *Tractatus Theologico-Politicus* is closely related to the general problem, because it aims to secure perfect freedom in carrying out the solution of the problem—freedom to think. The theory of the imagination worked out in this *tractatus* is one of the instruments with which to eliminate conflicting elements from the situation. In its application it receives further development and definition.

It is possible to overemphasize the influence on Spinoza's life and thought of his excommunication. "This compels me," he is reported to have said on receiving the news, "to nothing which I should not otherwise have done." (Pollock, *Life of Spinoza*, p. 19.) Nevertheless, the excommunication has an important significance, in that it was an overt expression of a deep-seated conflict between the old and the new, between sacred tradition and ritual, and the spirit of growing scientific

1 "At ideam veram simplicem esse ostendimus, aut ex simplicibus compositam, ut quae ostendit, quomodo et cur aliquid fit aut factum sit, et quod ipsius effectus objectivi in anima procedunt ad rationem formalitatis ipsius objecti; id quod idem est, quod veteres dixerunt, nempe veram scientiam procedere a causa ad effectus; *nisi quod nunquam, quod sciam, conceperunt, uti nos hic, animam secundum certas leges agentem, et quasi aliquod automa spirituale.*" (Italics mine.) (*Trac. de Intell. Em.*, p. 29.)

thought and political freedom. Spinoza was not indifferent to this conflict. His principal works, particularly this *tractatus*, show that he was keenly alive to it.

This conflict finds here its most concentrated expression in the separation of theology from philosophy, of obedience from freedom to think. The separation is explained and justified, to a very large extent, by means of an analysis of the gift and function of prophecy, and by a psychological distinction between the imagination and the understanding, developing with the analysis and at the same time controlling it.

The analysis of the gift and function of prophecy, which occupies the first two chapters of the *tractatus*, follows two somewhat different lines of argument, and brings out clearly two different aspects of the imagination. A comparison of the introductory sentences of each chapter will serve as a statement of the contrast, and will also set before us (*a*) the definition from which the first line of argument proceeds, and (*b*) the conclusion which the second line of argument aims to support by empirical data:

Prophecy, or revelation, is a sure knowledge revealed by God to man. A prophet is one who interprets the revelations of God to those who are unable to attain to sure knowledge of the matters revealed, and therefore can only apprehend them by simple faith.[1]

It follows from the last chapter that, as I have said, the prophets were endowed with unusually vivid imaginations, and not with unusually perfect minds.[2]

(*a*) A theory of the imagination becomes involved in the first of these two lines of argument as soon as the principle is laid down that the imagination is one of the three ways in which *certa cognitio* was revealed by God to man in the Scriptures, the other two being the *vera vox* that spoke to Moses, and the immediate communion of Christ with God—mind to mind. To be sure, Spinoza expressly states that the ordinary knowledge which we acquire by our natural faculties depends upon our knowledge of God and his eternal laws; that the feeling of intellectual certainty is of the nature of a divine revelation—an idea elaborated in Chap. IV, and destined to be of transcendent importance in the *Ethics*. But with reference to prophecy, in all instances, save those of

[1] "Prophetia sive Revelatio est rei alicujus certa cognitio a Deo hominibus revelata. Propheta autem is est, qui Dei revelata iis interpretatur, qui rerum a Deo revelatarum certam cognitionem habere nequeunt, quique adeo mera fide res revelatas amplecti tantum possunt." (Cap. i.)

[2] "Ex superiore Capite, ut jam iudicavimus, sequitur, Prophetas non fuisse perfectiore mente praeditos, sed quidem potentia vividius imaginandi, quod Scripturae narrationes abunde etiam docent." (Cap. ii.)

Moses and of Christ, the imagination is the sole instrument of divine revelation. Toward the close of the argument the deepest significance attaching to this instrument is made to depend on a *quatenus*, which in turn involves the moral character and peculiar power of the prophets, and finally depends upon the nature of a prophecy, as defined in the first paragraph of the chapter, quoted above, thus completing the circle and identifying imagination with the mind of God. More in detail, Spinoza enters upon a full discussion of the various meanings of the Hebrew word for "spirit," with the end in view of determining the relation between spirit and prophecy, as illustrated in such scriptural phrases as: "The spirit of the Lord was upon a prophet," "The Lord breathed his spirit into men," "Men were filled with the spirit of God, with the Holy Spirit," etc. Such phrases mean, he concludes, "that prophets were endowed with peculiar and extraordinary power, and devoted themselves to piety with a special constancy; that thus they perceived the mind or thought of God; for it has been shown that God's spirit signifies in Hebrew God's mind or thought, and that the law which shows his mind and thought is called his spirit; hence the imagination of the prophet, in so far as (*quatenus*) through it were revealed the degrees of God, may equally be called the mind of God, and the prophets be said to have possessed the mind of God."[1] *Quatenus*, if it reduces the possibility of divine revelation to zero, makes the original definition of prophecy a mere form of words for a thing that has never existed. If, on the other hand, there has been such a thing as prophecy in the scriptural sense — and Spinoza never goes so far as to express a doubt of this assumption — then "in so far," *quatenus*, the imagination of the prophets and the mind of God were one.

It is worth noting that in the paragraph immediately following this part of the discussion, Spinoza confesses his ignorance of the particular way in which communication between the mind of God and the imagination of the prophet was effected, and declares the irrelevancy of any attempt at explanation.

(*b*) The second line of argument develops and endeavors to substantiate by evidence drawn from the Scriptures, and by an appeal to

[1] "Nihil enim aliud significant, quam quod Prophetae virtutem singularem et supra communem habebant, quodque pietatem eximia animi constantia colebant. Deinde, quod Dei mentem sive sententiam percipiebant; ostendimus enim, Spiritum Hebraice significare tam mentem quam mentis sententiam, et hac de causa ipsam Legem, quia Dei mentem explicabat, Spiritum sive mentem Dei vocari; quare aequali jure imaginatio Prophetarum, *quatenus* per eam Dei decreta revelabantur, mens Dei etiam vocari poterat, Prophetaeque mentem Dei habuisse dici poterant." (Italics mine.) (*Trac. Theol-Pol.*, cap. i, p. 390.)

common experience, the contrast between imagination and reason implied in the first sentence in Chap. II, quoted on p. 17. The most significant feature of the argument—a feature which not only anticipates the contrast between inadequate and adequate ideas in the *Ethics*, but also touches the core of Spinoza's philosophic method—is the nature of the distinction between the imagination and the understanding. It is a distinction between particulars and the universal; between particulars as expressed in terms of opinions, biases, mental images—in short, the capacities of the private, subjective individual as such—and the universal as it necessarily follows from the nature of the thing perceived or seen. Out of this distinction grows on the logical side a distinction between two kinds of certitude, two kinds of validity—moral and mathematical. One line of certitude, the kind which the prophet experienced, is afforded by signs extrinsic to the revelation itself: "Simplex imaginatio non involvat ex sua natura certitudinem." Instances are given of the verification of prophecy by signs, which show "Prophetas semper signum aliquod habuisse, quo certi fiebant de rebus, quas Prophetice imaginabantur." (This statement is subsequently qualified: "Praeterea concedere possumus, Prophetas, qui nihil novi, nisi quod in Lege Mosis continentur, prophetabant, non indignisse signo, quia ex Lege confirmabantur.") The important point is that both sign and revelation varied according to the capacity and disposition of the individual. Numerous examples are given of the ways in which revelations may vary according to the mood, culture, and ideas of the individual prophets. Yet, differing as widely as they may in all these respects, there is one trait that true prophets share in common—high moral character. This affords the surest guarantee of certainty. "Nam Deus pios et electos numquam decipit." To give Spinoza's summary of the discussion with reference to the criteria of prophecy:

> The whole question of the certitude of prophecy was based on these three considerations:
>
> 1. That the things revealed were imagined very vividly, affecting the prophets in the same way as things seen when awake.
>
> 2. The presence of a sign.
>
> 3. Lastly and chiefly, that the mind of the prophet was given wholly to what was right and good. (Chap. II. This summary is repeated and expounded further in Chap. XV.)

Set over against prophetic certainty, or moral certainty, is mathematical certainty. The nature of this kind of certainty is intrinsic

and deductive, self-involved and self-evolving. "Prophetica igitur hac in re naturali cedit cognitioni, quae nullo indiget signo, sed ex sua natura certitudinem involvit" (p. 393). The distinction between the two kinds of certitude is imbedded in a remarkable sentence, which may be quoted as a summary of the principal points brought out thus far:

> As, then, the certitude afforded to the prophets by signs was not mathematical (*i. e.*, did not follow necessarily from the perception of the thing perceived or seen), but only moral, and as the signs were only given to convince the prophet, it follows that such signs were given according to the opinions and capacity of each prophet, so that a sign which would convince one prophet would fall far short of convincing another who was imbued with different opinions. Therefore the signs varied according to the individual prophet. (Chap. II, E, p. 29, and L, p. 393.)

From this discussion of the first two chapters of the *tractatus*, involving points which, as Spinoza states at the close of the second chapter, are the only ones bearing on the end in view, namely, "ad separandam Philosophiam a Theologia," it is evident that we have to consider, on the one hand, two aspects of the imagination, two apparently irreconcilable aspects: (1) imagination as the sole instrument of the divine revelation of sure knowledge, *certa cognitio*, in all prophecy (save in the case of Moses and of Christ), as one with the mind of God; and (2) as a particular, in the sense of private, variable, subjective, partial, embodiment of moral law. On the other hand, we have to consider understanding, *intellectus* "claris et distincta idea," which is its own witness of the truth. It is difficult to see how there can be any opposition between the first aspect of imagination and the understanding. It is also difficult to see how it is any easier to reconcile the two aspects of imagination with each other than it is to reconcile the second aspect with the understanding itself. In short, the analysis gives us a two-faced imagination *versus* the understanding or *intellectus*.

But this is not the place and time for a criticism as to logical consistency. Return we first to the problem itself and see how far the results of Spinoza's psychological and logical analysis will meet the situation successfully. Tradition, based on prophetic revelation, is at war with growing scientific and speculative thought. The conflict constitutes the problem. What Spinoza proposes as a solution is a cessation of hostilities. He aims to define the province of each, so that each must remain within its own, and so that there will be no future possibility of conflict. To theology he assigns far the larger area —

practically the whole of moral education and spiritual guidance. Theology is given jurisdiction over the many-headed multitude, over those who are untrained in "the deduction of conclusions from general truths *a priori*," and who "seek each for himself his own selfish interests, with no thought beyond the present and the immediate object." To them theology or religion — both as worship and as exponent of the highest moral law — can make its appeal, not in the form of reasoning deductively from axioms and definitions, but only in terms of concrete human experiences. The law must be incarnated in particulars so vivid and personal that it becomes a living reality to him whose mind cannot grasp a clear and distinct generalization. The law can be effective only as it becomes some particular fragment of the individual's fragmentary life. Hence the function of prophecy was the function of adapting the universal moral law and will of God to the clouded and finite intelligences of the vast majority of humankind. "Propheta autem is est, qui Dei revelata iis interpretatur, qui rerum a Deo revelatarum certam cognitionem habere nequeunt, quique adeo mera fide res revelatas amplecti tantum possunt." It is hardly necessary to state that according to Spinoza the function of prophecy and of theology was not to promote religious ecstasy; its function was social, moral — to effect through obedience to the law, as felt by the individual, a secure and permanent organization of society. Of especial significance in this connection are the chapters on the vocation of the Hebrews, and the Hebrew theocracy, which declare that vocation to have been a monopoly neither on virtue nor on intelligence, but the establishment of a highly perfected and long-enduring social organization, in which religious, moral, and political control was one in the spirit of reverent and joyful obedience to laws divinely revealed.

To philosophy, on the other hand, Spinoza assigns the narrow territory of the deductive or mathematical method of developing the divine law from clear and distinct ideas — narrow, because this rational insight into the divine nature of things is the blessed possibility of only a few. It, too, however, leads to salvation.

> Even he who should be ignorant of Scripture narratives, but who should know by natural reason (*lumine naturale*) that God exists, and who should have a true plan of life, would be altogether blessed — yes, more blessed than the common herd of believers, because besides true opinion he would possess also true and distinct ideas.

It was most essential, however, not merely to assign different provinces to theology and philosophy, but to establish boundary lines that

could never be infringed upon; to show how the two could never again, from the nature of the case, be at war with one another. There were three instruments with which Spinoza endeavored to bring this about: (1) a theory of the imagination, (2) historical-biblical criticism, (3) a theory of the state. It would be difficult, perhaps irrelevant, to decide which of the three was of the most fundamental importance. All I shall attempt to do is to point out the function of the first, namely, of the theory of the imagination. The divinely revealed subject-matter of the Scriptures is the only subject-matter and body of doctrine, according to Spinoza, that theology can have; for it is doubtful whether there have been any latter-day prophets. That subject-matter was given and retained solely in terms of the imagination (excepting, always, in the case of Moses and of Christ). To speak more explicitly, that subject-matter was given and retained in terms of private, individual imaginations, flatly contradicting one another in mood, in training, and in matters of rational knowledge and belief. Therefore, the content of theology is embodied in individualistic terms, and is partial, variable, beclouded, and wayward. There is *moral* agreement between the particular, individualistic terms, a practical social unity to which they contribute, but no necessary *intellectual* agreement, no rational unity. The imagination is so arbitrary, so subjective, so partial—in both senses of the word—that it acquired certitude, validity, in prophecy, only through the presence of an objective, corroborating sign or witness. And even this sign or witness was not purely objective and rational, but varied with the character of the individual prophet. The very nature of the imagination, and the very nature of the unrationalized individual who exercised it in prophecy, determine in themselves — or in itself, for both are one — the limits of theology. Beyond its particular and concrete content theology cannot logically pass. Its law was given by revelation, not derived by reason. Its law was revealed unto the flesh, not born of the spirit. Theology can read its data backward, but not forward — backward to the source, but not forward to a new generalization. Contradictory particulars may reflect the law, but the law cannot originate with them. It is just as possible for the logically discrepant particulars of the imagination to generate a universal as it is for the differing rays of light from "the many-colored dome of glass" to become what they once were, "the white radiance of eternity."

The success of Spinoza's theory of the imagination is apparent, if we accept his premises. The theory simply disarms theology of its

weapons of attack upon philosophy — or rather shows that theology has never possessed any logical weapons of attack upon the province of rational knowledge. Logically, theology must either abandon its own province altogether, renounce its revealed doctrine, and abdicate its authority over the hearts and the morals of the community; or else it must keep strictly within its broad territory, and make no attempt to limit the freedom of philosophic thought. Take into account as well the reinforcements which the theory of the imagination receives both from Spinoza's discussion of the authorship of the Scriptures — in which he anticipates the standpoint of modern biblical scholarship — and from Spinoza's theory of the state, which aims to show that the safety of the state lies in "the rule that religion is comprised solely in the exercise of charity and justice, and that the rights of rulers in sacred, no less than in secular, matters should merely have to do with action, but that every man should think what he likes and say what he thinks" — take all this into account, and it is difficult to see that theology has not been excommunicated from philosophy as absolutely as Spinoza was excommunicated from the synagogue, only dispassionately and with no breathing of curses.

Yet may we not fairly ask: Is this a solution *sub specie aeternitatis?* Problems
(1) How long will a two-faced imagination be at peace with itself? How
(2) long can the imagination and the understanding get on without each other?

III. The *Ethics.*

The theory of the imagination involved in the *Ethics* is the same theory as the one involved in the two *tractati*, but with further developments and applications. The *Ethics* may be regarded as a more complete fulfilment of the logic worked out in the *Tractatus de Intellectus Emendatione.* In harmony with that logic, its movement may be described as the deductive evolution of the standard idea of an absolutely perfect being; and its goal may be described as the intellectual unity of the self with nature, with humanity, and with God — the complete rationalization of existence. "Spinoza's greatness," says Höffding (*History of Mod. Phil.*, Vol. I, p. 314), "consists in the resolute carrying out of the thought that existence must be rational; from which he concludes that its essence must be identity — absolute unity." Now, opposed to such a unity, to such a goal, is the imagination. Though rejected, it is still a lion in the path. For, as stated in the appendix to Book I of the *Ethics*, and as has been stated in the previous *tractati*, the imagination is found to be the source of all

confused, erroneous, and inadequate ideas—these being the indices of personal prejudices, of individual capacities and limitations. This may be taken as an extremely condensed form of the theory of the imagination in the *Ethics*, in its resemblance to that of the *tractati*. The following are the important additions to the theory, or developments of points previously implied:

1. A physiological explanation of the origin of the imagination.

2. A psychological explanation of the imagination as the source of error.

3. Imagination the correlate of the body rather than the representative of the object.

4. Relation of the imagination to the emotions.

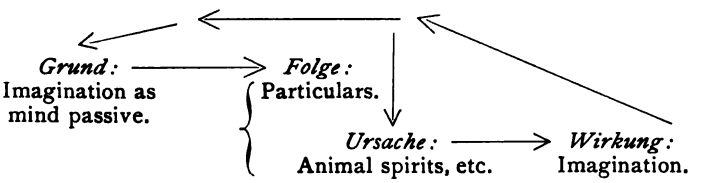
5. Teleology and freedom as illusory.

1. Spinoza gives a physiological explanation of the imagination on the hypothesis of animal spirits (II, 17, Cor. Proof). The statement is perfectly clear so far as it goes. But a comparison of this passage with I, 15, Sch., brings out an interesting contradiction. The animal-spirits hypothesis, according to which Spinoza explains the origin of the imagination, involves the assumption of the existence of particular things: (1) external objects; (2) animal spirits, or the fluid parts of the human body; (3) the softer parts of the human body. In I, 15, Sch., however, he explains the origin of particular, finite things on the basis of the nature of the imagination as opposed to the intellect. In the former case we imagine because we are particularized, so to speak—we are acted upon by particular, finite things; in the latter case, on the other hand, we particularize because we imagine.[1] A remark let fall by Hume is pertinent here: "The same principle cannot be both the cause and the effect of another; and this is, perhaps, the only proposition concerning that relation, which is either intuitively or demonstratively certain" (p. 90). There is one way out of the contradiction involved in Spinoza's analysis of the imagination: regard it as self-caused. But that will never do, for that would identify it with Substance.

This apparently fatal circle of reasoning is not to be dismissed as a logical curiosity. It points to a deeper consequence; it frames and defines the nature of the underlying problem. This eddy in the current of Spinoza's stream of thought is a witness alike to the logic of rejection and to the ideal of unity. It marks a point at which the

[1] My indebtedness to Professor Dewey for this point is specific. See his article on the "Pantheism of Spinoza," in *Jour. of Spec. Phil.*, Vol. XVI, p. 249.

identity between *Ursache* and *Wirkung*, and *Grund* and *Folge*,[1] breaks down; neither series is complete; each borrows from, and lends to, the other. The categories may be diagrammed thus:



2. Closely related to what I have called a physiological explanation of the imagination is the explanation of why the imagination is a source of error and confusion (II, 40, Sch. 1). Both rest on the assumption of animal spirits and all that it implies. Spinoza conceives the body to be capable of forming only a certain number of images within itself at the same time. If the number be exceeded, the images will begin to be confused. If this number be largely exceeded, the images will become entirely confused with one another. In all this the mind parallels the body. Spinoza would not agree with Plato (*Theaetetus*, 194) that "the wax in the soul of anyone could be sufficiently deep and abundant, smooth and perfectly tempered," "pure and clear," so that "the impressions which pass through the senses and sink into the heart of the soul" could be retained as "true thoughts" "not liable to confusion." For Spinoza every soul would be, in this respect, essentially limited in the amount, if not in the quality, of its "wax." Like Plato, however, he would ascribe indistinctness and confusion to a multitude of impressions, "all jostled together in a little soul, which has no room."

The point of the explanation was its application. And the application was made in accounting for the origin of general or generic terms, such as "being," "thing," "man," "horse," "dog," etc. "They arise, to wit, from the fact that so many images, for instance, of men, are formed simultaneously in the human mind, that the powers of the imagination break down, not indeed utterly, but to the extent of the mind losing count of small differences between individuals, *e. g.*, color, size, etc., and their definite number, and only distinctly imagining that in which all the individuals, in so far as the body is affected by them, agree" (II, 40, Sch. 1).

[1] *Cf.* MAX RACKWITZ, *Studien über Causalität u. Identität als Grundprincipien des Spinozismus* (Halle, 1884).

All that Spinoza has said with reference to this point is practically an indictment of empirical or "inductive" logic. It is an indictment of any logic that regards generic ideas as common elements abstracted from particular instances, or made after the fashion of a composite photograph.

So far as the whole theory of the imagination is concerned, however, the most significant feature of this particular explanation is its bearing on Spinoza's concept of the individual — a concept whose fundamental importance becomes more and more apparent as our discussion proceeds. Although the generic term is formed by abstracting the common element, and by losing track of differences, it does not follow that a generic term possessed by one individual will be identical with the generic term of the same name possessed by any other individual. This for the reason that the images from which the term is abstracted are never alike in any two individuals. "We must, however, bear in mind that these general notions are not formed by all men in the same way, but vary in each individual according as the point varies whereby the body has been most often affected, and which the mind most easily imagines or remembers" (II, 40, Sch. 1). In so far as we, as individuals, "form our general notions by abstracting them from particular things represented to our intellects fragmentarily, confusedly, and without order, through our senses," we have the kind of knowledge that may be called opinion or imagination (II, 40, Sch. 2).

3. Imagination the correlate of the body, rather than the representative of the object.

This point is simply a phase of the two preceding points. "The imagination is an idea which indicates rather the disposition of the human body than the nature of the external body; not indeed distinctly, but confusedly; whence it comes to pass that the mind is said to err" (IV, 1, Sch.). Spinoza would differentiate clearly between the idea of Peter which constitutes the essence of Peter's mind, and the idea of Peter which is in another man, say Paul. The first is a true representative idea. The second is quite likely to be imagination; it indicates rather the disposition of Paul's body than the nature of Peter (II, 17, Sch.). If we ask Spinoza how an individual can ever form an idea that does not indicate the present disposition of his body, rather than the nature of the object, we are, of course, referred to the parallelism of attributes. Or, if we pursue the matter and ask why the parallelism of attributes will not assure to the correlate of the body the validity of a representative of the object, we shall come upon the

doctrine of error as privation (II, 23, 25, and IV, 1, Sch.). To use his illustration, when we look at the sun and imagine it to be but two hundred feet distant from us, the error does not lie solely in the imagination *per se* (*cf.* II, 17, Sch., last part), but in the fact that we do not yet possess the true knowledge of its distance. In other words, the error consists in taking the appearance for the reality. Error is, so to speak, negative reality.

4. Relation of the imagination to the emotions.

When Spinoza, in a "General Definition of the Emotions" (conclusion of Part III), states that "emotion, which is called a passivity of the soul, is a confused idea," etc., it is evident that emotion and imagination have been brought into close relationship to one another. What, then, we ask, is the nature and significance of this relationship? I doubt the relevancy of entering upon a detailed discussion of Spinoza's theory of the emotions, and I therefore submit with little argument the following propositions: What the imagination is to knowledge, the emotions are to conduct. In other words, what the imagination is to the understanding, the emotions are to the will. According to II, 49 Cor., the understanding and the will are identical. Is there any distinction to be made between imagination and emotion? Höffding calls attention to a contradiction between II, 49 Cor., and III, 9, Sch. According to the latter reference, knowledge is made dependent on will. However this may be, Spinoza appeared to regard the emotions, particularly desire, as presenting more of the active element of the mind than the imagination, which he repeatedly characterizes as the mind passive. "Desire is the actual essence of man, in so far as it is conceived, as determined to a particular activity by some given modification of itself . . . . By the term 'desire,' then, I here mean all men's endeavors, impulses, appetites, and volitions, which vary according to each man's disposition, and which are therefore not seldom opposed to one another, according as a man is drawn in different directions, and knows not where to turn" (III, "Definitions of Emotion," I). Put this with the definition of emotion (III, Def. III), and with the important *Nota Bene*, and the nature of the distinction between the emotions and imagination, and also the correspondence of one with the other, will be evident:

> By emotion I mean the modification of the body, whereby the active power of the said body is increased or diminished, aided or constrained, and also the ideas of such modifications. *N. B.:* If we can be the adequate cause of any of these modifications, I then call the emotion an activity, otherwise I call it a passion, or a state wherein the mind is passive.

Emotion, thus viewed, partakes of the nature of both understanding and imagination, of both adequate and inadequate ideas. A good deal depends, of course, upon the "if" in the *Nota Bene*. In the last two books of the *Ethics* it is Spinoza's problem to show how it is truly possible for emotion to be an activity of the mind. A principle of activity is postulated in the emotion which may become its salvation. This view of emotion is due, I believe, to the fact that Spinoza kept in mind and emphasized the physiological side of emotion. "By emotion I mean the modifications of the body, whereby the active power of the said body," etc.; whereas the physiological explanation of the imagination appears to have been developed after the logical and psychological sides had already been worked out. The word "emotion," then, is used in two senses: (1) as an activity corresponding to, if not identical with, the activity of intelligence; (2) as passion, corresponding to the imagination.

Emotion as passive is akin to imagination in two important aspects: (1) It represents the element of individual variation, in the sense of haphazard discrepancy—"impulses, appetites, and volitions, which vary according to each man's disposition, and which are therefore not seldom opposed to one another," etc. We have seen this element of spontaneous variation to be also a prevailing characteristic of the imagination, both in the *tractati* and in the *Ethics*. It is a form in which Spinoza's earliest problem persists, and which he is continually endeavoring to get rid of. (2) It represents the fact that the individual finds himself overpowered by causes external to him. Man is a prey to his passions. (Preface to IV; also IV, especially 2, 3–6.) The individual as such is conditioned to act by another finite thing, and that by another, and so on to infinity (I, 28). "The force whereby a man persists in existing is limited, and is infinitely surpassed by the power of external causes" (IV, 3). The whole doctrine of finite modes is involved. (*Cf.* I, Def. V, and proof to I, 28.) "Hence it follows that man is necessarily always a prey to his passions, that he follows and obeys the general order of nature, and that he accommodates himself thereto as much as the nature of things demands" (IV, 4, Cor.). Passion results from the feeble struggle of the activity of the self against the overwhelming odds of nature. So feeble is the resistance offered by the self that the whole being appears to be helplessly swept along in the irresistible flood of passion. "We are in many ways driven about by external causes, and, like waves of the sea driven by contrary winds, we toss to and fro, unwitting of the issue and of our

fate" (III, 59, Sch.). All this is in principle equally true of the imagination, though it is stated in the more remote and colorless terms of logical theory. The physiological explanation of imagination and of the way it forms abstractions from data — literally data — as discussed above, on pp. 24, 25, bears out the point.

5. Teleology and freedom as illusory.

Other aspects of the theory of the imagination in the *Ethics*, such as the illusion of freedom and the doctrine of final causes, though of great importance, do not demand a full discussion here, for they are simply inevitable applications of the theory as it has been repeatedly stated. Self-conscious freedom and the doctrine of final causes represent for Spinoza wholly gratuitous projections of personal prejudices into the realm of natural law, self-deceptive attempts to derive a whole from discrepant and variable fragments (*cf.* I, Appendix; also III, 2, Sch.).

The scope of this discussion does not include the *Tractatus Politicus*, for the reason that this *tractatus* contains no mention of the imagination. But the fact itself is sufficiently important to mention. The rôle played by the imagination in the writings discussed above is assigned to the passions in the *Tractatus Politicus* — the passions *versus* reason. And the passions of the *tractati* are the passions of the *Ethics*, which, as we saw, correspond closely to the imagination. (*Cf.* Chaps. I, 5; II, 5, 6, 8, 14, 18; III, 6; VI, 1; VII, 2, 4.) Men are led more by blind desire than by reason. The passions to which men are prey make them enemies of one another. In the state of nature, every man, of course, has the right to do exactly as he pleases; that is, the individual as natural is a sovereign — he can do no wrong. But his right to do exactly as he pleases is limited by his might, which in turn is so limited by the natural forces of which he is but a part, and by other hostile individuals, that his right is practically a nonentity, "existing in opinion rather than in fact." Hence there gradually emerges some form of co-operation among men, some attempt to live according to reason, which is the law of common welfare (*cf. Ethics*, IV, 35, and Sch. 1 and 2).

Spinoza's political theory readily lends itself to a statement in physical terms. Every individual is an atom possessing two qualities — the power of repelling all other atoms, passion; and the power of attracting all other atoms, reason. As a gas becomes a solid, so does the state of nature become a commonwealth. But Spinoza in his quest for unity would reject the passions altogether, as mere empty space, and keep only the solidarity of the atom.

This is not intended to be a fair or adequate statement of Spinoza's political theory. The theory of the imagination or of the passions does not receive in the *Tractatus Politicus* a new development that would warrant an attempt to discuss the matter fully, but perhaps enough has been said to indicate the general drift of the political theory and the part assigned to the externally conditioned individual.

SEC. IV. SUMMARY OF THE STATEMENT OF SPINOZA'S THEORY OF THE IMAGINATION.

It must be evident that the dualism into which Spinoza has fallen cuts far deeper than the psycho-physical dualism of Descartes. The dualism finds expression in the following forms:

Imagination *vs.* understanding.
Theology *vs.* philosophy.
Inadequate *vs.* adequate ideas.
Causes external *vs.* causes immanent.
Passions *vs.* reason or virtue.
Time *vs.* eternity.
Finite quantity *vs.* infinity.
Multiplicity of modes *vs.* unity of substance.
Necessity *vs.* freedom.

It is evident that the dualism may be approached from a psychological, ethical, logical, or metaphysical standpoint. I shall endeavor to keep within close range of the psychological standpoint.

Spinoza's problem, as we have seen, took its rise in a dissatisfaction which, though undoubtedly an expression of his character and training, was given an objective reference; it was a dissatisfaction with the commonly accepted goods of life — riches, fame, and pleasure. The end proposed as a solution, that *verum bonum*, was also given an objective reference. It was that object which a man might love and never find wanting. In the process of getting from the uncertain and fleeting objects of the present to the contemplation and love of that fixed, supreme, and eternal object, a psychological mechanism had to be invented and worked out. The self was found to be made up of imagination and appetites, on the one side, and of understanding or reason, on the other. To the world of uncertain and fleeting objects corresponded the imagination and the appetites. To the unity of the whole world of nature corresponded the reason. The problem was solved in its very statement — solved, that is, by identifying the imagination with things finite (in the *Ethics* we saw how this identification

was effected through the circular reasoning that made the imagination the cause of things finite and things finite the cause of the imagination), and then separating the imagination from reason. Much as the early Christian monks treated the world, the flesh, and the devil, so did Spinoza treat the imagination; only that he rejected it, not for the sake of an other-world salvation, but for the sake of salvation in the eternal present of this world. It is perhaps impossible to overestimate the importance of the fact that Spinoza finally brought a psychological analysis to bear upon his problem. To so great an extent, however, was the analysis simply a reflection of the two kinds of objects with reference to which it was made that the self which he dissected out fell into two parts, quite as antagonistic and irreconcilable as the two kinds of objects given in the first place.

Many critical questions have suggested themselves throughout the discussion, and still persist. They may be concentered in these two:

1. How far can manifold, fragmentary, finite particulars and the imagination be identified?

2. How far can reason and the imagination be dissociated? What becomes of the individual when cut in two in this fashion?

PART II.

HUME'S THEORY OF THE IMAGINATION.

I HAVE been able to discover no finer or more suggestive answers to the questions just raised than the development of English sensationalism, which was among other things a criticism, though an unconscious one, of Spinoza's theory of the imagination. The very elements rejected by Spinoza as sources of error and confusion became the foundations, the unquestioned data, of the philosophies and psychologies of Locke, Berkeley, and Hume.

It will probably be sufficient for our purpose to examine only Hume's theory of the imagination. For Hume recapitulates the sensationalism of his predecessors; at the same time frankly shearing away all inconsistent assumptions, and thus coming unawares upon inconsistencies in the central assumption itself.

I shall attempt to show that Hume's unconscious criticism of Spinoza has a twofold significance:

1. As revealing the value of an instrument that Spinoza criticised and discarded; and

2. As revealing, also, the difficulties in the way of elevating this instrument, as Hume proposed, to the rank of a supreme epistemological principle; or, to use Hume's words, to the rank of "the ultimate judge of all systems of philosophy" (p. 225). In a sense Spinoza was a critic of Hume, as well as Hume of Spinoza.

SEC. I. THE NATURE OF HUME'S PROBLEM.

Unlike Spinoza, Hume left behind him no explicit statement of the nature and origin of his problem. The nearest approach to such a statement is doubtless to be found in that sentence which Professor Huxley, in his work on Hume, regards as the keynote of the treatise:

> I found that the moral philosophy transmitted to us by antiquity labored under the same inconvenience that has been found in their natural philosophy, of being entirely hypothetical, and depending more upon invention than experience: everyone consulted his fancy in erecting schemes of virtue and happiness, without regarding human nature, upon which every moral conclusion must depend.[1]

[1] Huxley: *Hume, with Helps to the Study of Berkeley* (New York, 1894), p. 11.

But this sounds more like Bacon than like Hume. The problem with which Hume came to be concerned was not so much how philosophy may be founded on experience as how experience itself is constituted. Just what this problem was, or at least what one important phase of it was, will become evident, I believe, in the course of the following discussion of Hume's theory of the imagination. I will make only a brief preliminary statement with reference to it.

In shearing away all the inconsistent and metaphysical assumptions of his predecessors, Hume reduced sensationalism to sensations. The problem was how to build up out of these sensations the coherent and rational wholes of experience. It was in a way Kant's problem that Hume had to struggle with — the problem of how an individual experience is constituted, of how intrinsic relations are to be discovered and maintained, in place of the extrinsic metaphysical entities that had been begged or assumed in sensationalism up to that time. I shall attempt to show how Hume, in the straits of his problem, finally resorted to the imagination as the sole instrument capable of meeting the demand for a coherent and forward-moving individual experience.

SEC. II. SENSES IN WHICH HUME USES THE WORD "IMAGINATION."

The word "imagination" recurs frequently throughout the *Treatise of Human Nature*, and in different senses. Hume acknowledges at least three different uses of the term: (1) when opposed to memory; (2) when opposed to reason; (3) when opposed to neither, *i. e.*, when "it is indifferent whether it be taken in the larger or more limited sense," or when "at least the context will explain the meaning" (p. 117, note). In this sense it is usually equivalent to "fancy."

I. Imagination distinguished from memory.

Imagination and memory are alike in that they are both repetitions of impressions, reproductions of past perceptions. They differ in two respects: (1) "The ideas of memory are much more lively and strong than those of the imagination." Ideas of memory approach the vivacity of the original perceptions. Those of the imagination have lost that vivacity and have become perfect ideas. (2) Memory reproduces the arrangement of the original perceptions. Imagination is free to recombine them. "The imagination is not restrain'd to the same order and form with the original impressions; while the memory is in a manner ty'd down in that respect, without any power of variation." (Book I, Part I, sec. 3, and Part III, sec. 5.)

But Hume is too good a psychologist to allow these two distinctions to stand as hard and fast realities. In fact, he practically abandons both of them when he comes to the discussion of belief. In spite of the fact that memory preserves the order and arrangement of sense-perceptions, while imagination freely transposes them, we can never on that basis tell an idea of the memory from one of the imagination, "it being impossible to recall the past impressions, in order to compare them with our present ideas, and see whether their arrangement be exactly similar." Since, therefore, the memory is known neither by the order of its *complex* ideas nor by the nature of its *simple* ones — it being borne in mind that both memory and the imagination "borrow their simple ideas from the impressions, and can never go beyond these original perceptions" — it follows that the difference between it and the imagination lies in its superior force and vivacity. "A man may indulge his fancy in feigning any past scene of adventures; nor would there be any possibility of distinguishing this from a remembrance of a like kind, were not the ideas of the imagination fainter and more obscure" (p. 85). It now becomes difficult to see how the second distinction mentioned in the preceding paragraph can have any value whatsoever. Even if it be a true distinction, it is one of which we can never be directly aware; it must always rest upon an uncertainty: *if* our ideas with reference to any experience are relatively faint, we may infer that we are using the imagination, a faculty which *may* be exercising its power of independent reconstruction of ideas. But Hume will not allow even the first distinction mentioned in the preceding paragraph, the distinction of force and vivacity, to remain unqualified. An idea of the memory may lose its force and vivacity, and become an idea of the imagination. "We are frequently in doubt concerning the ideas of the memory, as they become very weak and feeble; and are at a loss to determine whether any image proceeds from the fancy or the memory, when it is not drawn in such lively colours as distinguish that latter faculty. I think, I remember such an event, says one; but am not sure. A long tract of time has almost worn it out of my memory, and leaves me uncertain whether or not it be the pure offspring of my fancy" (pp. 85, 86). "So, on the other hand, an idea of the imagination may acquire such force and vivacity, as to pass for an idea of the memory, and counterfeit its effects on the belief and judgment. This is noted in the case of liars; who by the frequent repetition of their lies, come at last to believe and remember them, as realities; custom and habit

having in this case, as in many others, the same influence on the mind as nature" (p. 86). But, we ask, if an idea may degenerate or develop in either direction, how is the distinction with reference to force and vivacity to be of any more service than the distinction with reference to correspondence and transformation? How are we to know whether a given idea is a fiction of the imagination or a faithful reproduction of past experience? If it has a force and liveliness, we must forsooth believe in it. But the idea itself may be either a faithful reproduction of past experience, or it may be a recombination and transformation of the imagination which has acquired such force and liveliness as to pass itself off for an idea of the memory. Hume would have us say, I presume, that *as a rule* belief, which is only another name for force and vivacity of perceptions and ideas, "attends the memory and the senses," and not the imagination; *as a rule*, remembering is believing —just as seeing is believing—and imagining may be more or less of illusion; but practically the distinction will not always hold true Sometimes we believe in the illusion, and disbelieve in the half-forgotten testimony of our senses. And Hume's psychology is so true to life that we can never tell whether we have a rule or an exception.

So much for the distinctions between imagination and memory, involving belief. Hume gives us no explanation of the origin of these distinctions, nor anything but hints as to the forces that sweep them away. Let us now see how it fares with

II. Imagination distinguished from reason.

"When I oppose imagination to the memory, I mean the faculty, by which we form our fainter ideas. When I oppose it to reason, I mean the same faculty, excluding only our demonstrative and probable reasonings" (p. 117, note.). The expression "the same faculty" is ambiguous in its reference; but subsequent statements make it clear that Hume identifies reason and imagination to some extent, *e. g.*, "to the understanding, that is, to the general and more established properties of the imagination" (p. 267). The distinction between imagination and reason grows sharper and deeper as the treatise proceeds—in this respect quite the contrary of the distinction between imagination and memory.

At first, imagination and reason appear to co-operate in one of the two worlds in which we live. These two worlds are (1) the world of memory and senses, with which, strictly speaking, in the nature of the terms as defined above, the imagination has nothing to do. This world is the system which we form of our impressions and ideas of

memory; "and every particular of that system joined to the present impressions we are pleased to call a reality. But the mind stops not here" (p. 108). And we have (2) the world of judgment, in which, as the following quotation will make evident, imagination and reason work together in harmony; it is that system of perceptions which is "connected by custom, or if you will, by the relation of cause and effect . . . . " (p. 108). And as the mind "feels that it is in a manner necessarily determined to view these particular ideas, and that the custom or relation, by which it is determined, admits not of the least change, it forms them into a new system, which it likewise dignifies with the title of *realities*. . . . . " (p. 108).

'Tis this latter principle which peoples the world, and brings us acquainted with such existence, as by their removal in time and place, lie beyond the reach of the senses and memory. By means of it I paint the universe in my *imagination*, and fix my attention on any part of it I please. I form an idea of Rome, which I neither see nor remember; but which is connected with such impressions as I remember to have received from the conversation and books of travelers and historians. This idea of Rome I place in a certain situation on the idea of an object, which I call the globe. I join to it the conception of a particular government, and religion, and manners. I look backward and consider its first foundation; its several revolutions, successes, and misfortunes. All this, and everything else, which I believe, are nothing but ideas; tho' by their force and settled order, arising from custom and the relation of cause and effect, they distinguish themselves from the other ideas, which are merely the offspring of the *imagination* (p. 108). [Italics mine.]

I have quoted the last paragraph in full, not only because it tells how harmoniously imagination and reason may work together, but also because it contains an example of the use of the word "imagination" in the third sense; that is, in a sense opposed or related neither to memory nor to reason. In other words, the paragraph contains two entirely ~~different~~ uses of the word. In the first instance the word is used in the sense of the handmaid of reason; its ideas have the "force and settled order arising from custom and the relation of cause and effect." In the second instance the word is used in the sense of mere fancy and caprice.

The occasional agreement and co-operation of the reason with the imagination is easier to note and record than the progress and outcome of the growing distinction and conflict between the two. I will not here attempt to trace all the turnings and windings of thought in and out and back and forth, in which reason is now "the discovery

of truth and falsehood" (p. 458), and now the probability of probabilities *ad infinitum*, "till at last there remains nothing of the original probability, however great we may suppose it to have been, and however small the diminution by every new uncertainty" (p. 182); and in which the imagination is now a mere fanciful transformation of ideas, and now the very foundation of the memory, the senses, and the understanding (p. 265), and the bearer of causation and the objective world; until at length we are pulled up short by the startling antithesis: "We have, therefore, no choice left but betwixt a false reason and none at all" (p. 265). For the main features of this shifting interplay and growing distinction and conflict will come to light, I hope, in the impending discussion of the active part or function that imagination plays in Hume's theory of knowledge.

III. Imagination distinguished from habit, association, and emotion.

There are other important distinctions and relations between imagination and other categories of the mind, involved in the treatise, which should be taken into account, although they seem not to have had nearly so much importance for Hume as the distinctions and relations discussed above, or else were taken for granted. They are (1) imagination and custom or habit; (2) imagination and the laws of association; and (3) imagination and the passions or emotions. As all but the last are involved in the discussion of causation and objectivity, brief statements will here suffice.

1. The relation between custom, or habit, and imagination is extremely intimate. Imagination is clay in the hands of the potter, custom. "Custom takes the start and gives a bias to the imagination" (p. 148).

A significant distinction between imagination and reason is made in connection with this point (pp. 147–9). Custom lies at the bottom of both imagination and reason, imagination being conceived as the mediator between custom and reason, in a way that recalls the schematism of Kant. "According to my system, all reasonings are nothing but the effects of custom; and custom has no influence, but by enlivening the imagination, and giving us a strong conception of any object" (p. 149). But imagination and reason are by no means identical or always in agreement. The imagination is, so to speak, the more plastic element, the more sensitive, fluent, impulsive element; whereas the reason is more staid and sober and responds only to general rules (Book I, Part III, sec. 15), to acknowledged and conserva-

tive principles. "The general rule is attributed to our judgment; as being more extensive and constant. The exception to the imagination; as being more capricious and uncertain" (p. 149).

2. The relation between the principles of association of ideas—resemblance, contiguity, and causation—is similar to the relation between the imagination and custom. Without these principles of association, chance alone, as Hume says, would join the ideas of the imagination. In the chapter treating of the "Connexion or Association of Ideas" (Book I, Part I, sec. 4) Hume does little more than mention that third principle of association, cause and effect, leaving a thorough examination of it to another occasion. Anticipating, however, our discussion of that examination, we may pause to note the circular reasoning involved in making the principle of cause and effect one of the guiding principles of the imagination, and then later in showing how the imagination is the only faculty that makes possible the idea of cause and effect. It would be anticipating too much to attempt to bring out at this point the full significance of this circle. It suggests the circular reasoning into which Spinoza fell in considering the relation between the imagination and things finite.

Another significant distinction between imagination and reason comes out in connection with this point. Reason is totally inadequate to afford any basis for the principles of association. Only the imagination can do this.

> Reason can never shew us the connection of one object with another, tho' aided by experience, and the observation of their constant conjunction in all past instances. When the mind, therefore, passes from the idea or impression of one object to the idea or belief of another, it is not determined by reason, but by certain principles, which associate together in the ideas of these objects, and unite them in the imagination. Had ideas no more union in the fancy than objects seem to have to the understanding, we could never draw any inference from causes to effects, nor repose belief in any matter of fact. The inference, therefore, depends solely on the union of ideas. (P. 92.)

3. A discussion of the relation between the imagination and the passions, or emotions, involving Hume's fundamental moral category—sympathy—would take us too far afield of the theory of knowledge. It would hardly be relevant to our purpose to examine how "'tis on the imagination that pity entirely depends" (p. 371), or how "'tis certain, that sympathy is not always to the present moment, but that we often feel by communication the pains and pleasures of others, which are not in being, and which we can only anticipate by the force

of the imagination" (p. 385). But, at the risk of apparent digression, I should like to call attention to a very fine piece of psychological analysis in Book I, which, in discovering the mutual reinforcement of the imagination and the emotions, anticipates the modern organic-circuit interpretation of the reflex-arc theory. I will quote the whole paragraph, italicizing the most significant passage:

> . . . . custom takes the start, and gives a bias to the imagination.
>
> To illustrate this by a familiar instance, let us consider the case of a man, who being hung out from a high tower in a cage of iron cannot forbear trembling, when he surveys the precipice below him, tho' he knows himself to be perfectly secure from falling, by his experience of the solidity of the iron, which supports him; and tho' the ideas of fall and descent, and harm and death, be derived solely from custom and experience. The same custom goes beyond the instances, from which it is derived, and to which it perfectly corresponds; and influences his ideas of such objects as are in some respect resembling, but fall not precisely under the same rule. *The circumstances of depth and descent strike so strongly upon him, that their influence cannot be destroyed by the contrary circumstances of support and solidity, which ought to give him a perfect security. His imagination runs away with its object, and excites a passion proportioned to it. That passion turns back upon the imagination and enlivens the idea; which lively idea has a new influence on the passion, and in its turn augments its force and violence; and both his fancy and affections, thus mutually supporting each other, cause the whole to have a very great influence upon him.* (P. 148.)

We certainly have before us a remarkable instance of how far Hume's native psychological sagacity could outrun the sensationalistic inheritance, which he elsewhere accepts uncritically. Had he only been able to take his man out of the iron cage which was hung out from the high tower, and set him down on firm ground, he might never have become the traditional means of awakening Kant from his dogmatic slumber.

To conclude this portion of the subject. One thing is so evident, I believe, as not to need emphasis or further discussion — the fact that Hume wavers between a structural and a functional statement of the categories of the mind; between an attempt to set up distinctions and determine boundary lines, on the one hand, and a candid recognition of the active, living, functioning character of the elements singled out by and for critical analysis, on the other. On the side of description, of structural distinctions, are (1) sense-perception, (2) memory, (3) imagination, (4) reason, (5) habit, (6) principles

of association, (7) emotions. They can be made to hold still, as it were, long enough to have their pictures taken. But on the side of explanation, of functional interpretation, note the interplay, the protean shifting of character, the cinematographic display of activity. Sense-perceptions become either memory or imagination. Memory fades to imagination. Imagination wakes into memory — or more, imagination, after transforming and recombining the material given by sense-perceptions and memory, wakes into a new memory, or to an illusion that is taken for a memory. Reason and imagination are as one, like man and wife; and then they fall out, and quarrel with one another till they find out that another element, custom or habit, has made them what they are, and till they learn that one of them is simply *a deeper, more permanent crystallization of habit than the other*. But reason has lost its plasticity, its progressive quality; with the help of imagination it can give us the old world, the old Rome, but not the new; it is a hopeless Tory. Therefore it is denied all participation in the principles of association. Imagination, however, can give us a new world, growing out of the old; it is more like a Liberal Unionist. And finally we have the whole circuit of activity. Sense-perception reacts into conflicting habits; ideas of memory and of imagination are brought into play; these ideas exite the emotions; the emotions in turn reinforce the sense-perceptions and react upon the imagination and "enliven" the idea, thereby making it more believable; and so on, causing "the whole to have a very great influence" on the man.

We miss in Hume the brave show of logical consistency that we found in Spinoza. We miss the sense of completeness and finality that comes with a view of Spinoza's deductive hierarchy of systematic thought. Hume's analysis may, in contrast, appear to reduce the world of the spirit to chaos. But there is life here. There may be small hint of division of labor, but there is a forecast of organic activity. There is a basis for a fine skepticism of rigid class distinctions, and for a faith in onward movement.

SEC. III. THE FUNCTION OF THE IMAGINATION IN THE THEORY OF KNOWLEDGE.

The function of imagination in Hume's theory of knowledge can be stated in a few words. It is the faculty which makes it possible for us to have the conception of causation and the conception of objectivity. Hume's expression for objectivity is the continued and distinct, or independent, existence of objects.

Hume never doubts the reality of causation or of objectivity, as I understand him, but is concerned solely in accounting for the way in which we come to have believable ideas of such realities. "We may begin with observing that the difficulty in the present case is not concerning the matter of fact, or whether the mind forms such a conclusion concerning the continued existence of its perceptions, but only concerning the manner in which the conclusion is formed, and principles from which it is derived" (p. 206). The same would be true of causation. Hume becomes a skeptic with reference to all existing explanations of the way in which we come to form ideas of such realities, as I shall attempt to bring out in the course of this discussion, rather than a skeptic with reference to the existence of these realities themselves. In short, his interest seems to be psychological, rather than metaphysical or epistemological.

Causation involves three essential factors: contiguity, or relations in space; succession, or relations in time; and *necessary connection.* The first two are given in ordinary sense-perception. But whence is the idea of necessary connection derived? If we observe that objects of one sort follow immediately objects of another sort, and if we remember to have observed that this has been the case in all past instances in which these objects have been concerned, we say that they are *constantly conjoined,* and that in such a constant conjunction the antecedent is the cause of the consequent (Book I, Part III, sec. 6). Constant conjunction, at first sight, seems to be the same as necessary connection, just as a case of unvarying *post hoc* would to all practical intents and purposes be the same as a *propter hoc;* provided, Hume would have to add, that we could know beforehand in some miraculous way that this *was* a case of unvarying *post hoc.* And yet "this new-discovered relation of a constant conjunction seems to advance us but very little on our way" (p. 88). For constant conjunction is nothing but the multiplication of instances. If a single instance of conjunction between two objects can never give us the idea of necessary connection, how can we get such an idea from the mere repetition of this instance? "From the mere repetition of any past impression, even to infinity, there never will arise any new original idea, such as that of a necessary connexion; and the number of impressions has in this case no more effect than if we confined ourselves to one only" (p. 88).

The senses and the memory, then, can never give us the concept of causation. There remain two other possible sources, the reason and the imagination. Hume asks reason first.

In reason?

"If reason determined us, it would proceed upon that principle, *that instances of which we have had no experience must resemble those of which we have had experience, and that the course of nature continues always the same*" (p. 89). Such a proposition must rest either upon demonstrative knowledge or upon probability. It cannot rest upon demonstrative knowledge, for we have no demonstrative arguments that transcend experience. Neither can it rest upon probability, for even probability has to have some objective data on which to work; it can have nothing whatever to say in regard to those "instances of which we have had no experience." "Probability, as it discovers not the relations of ideas, considered as such, but only those of objects, must in some respects be founded on the impressions of our memory and senses, and in some respects on our ideas" (p. 89). Then follows one of the most remarkable sentences in the whole treatise, significant not only in its bearing upon present discussion, but in its anticipation of the famous dictum of Kant that forms of thought without sense-perceptions are empty, and sense-perceptions without forms of thought are blind: "Were there no mixture of any impression in our probable reasonings, the conclusion would be entirely chimerical: And were there no mixture of ideas, the action of the mind, in observing the relation, would, properly speaking, be sensation, not reasoning" (p. 89).

The next step is the subtle distinction between presumption and probability. The idea of cause and effect is only a presumption. We *presume* the existence of an object similar to the usual attendant of another object. Now, the *probability* of cause and effect is unquestionably founded upon this presumption. But therefore it is impossible that this presumption can arise from probability. "The same principle cannot be both cause and effect of another; and this is, perhaps, the only proposition concerning that relation, which is either intuitively or demonstratively certain" (p. 90).

Reason, then, which can create no new idea, is unable, either through demonstrative or probable arguments, to derive for us the concept of causality. The idea of necessary connection has been reduced to the narrow limits of a bare presumption.

In imagination?

The imagination is the last resort. What is needed is some kind of psychological basis for the presumption which will transform it into an idea of necessary connection. In other words, what is needed is a faculty sufficiently plastic and coherent to carrry the mind beyond the present object or idea to an idea not present, but resembling the

usual attendant of the present object or idea. This is exactly what imagination seems to be capable of doing, for "the imagination when set into any train of thinking, is apt to continue, even when its object fails it, and like a galley put in motion by the oars, carries on its course without any new impulse" (p. 198). The imagination is all the more inclined to do this, if the contiguous and successive objects have been repeated. The more frequent the repetition of any given contiguous and successive objects has been, the more readily the imagination passes from the given present object to an idea resembling its absent attendant; that is, from the experienced to the not-experienced. In other words, constant conjunction, operating upon the imagination by means of the principles of the association of ideas, makes possible what neither sense nor reason could give, namely, ideas which are not given in and through the present experience, but which resemble the impressions usually had in conjunction with this object which is now the sole content of sense-experience. *When the mind in and through the carrying or propensive quality of the imagination passes from a present object to an absent attendant, it reasons from cause to effect, or from effect to cause.*

But how does the mind *know* that it reasons thus from cause to effect? How does it thereby get the *idea* of causation? "The repetition of perfectly similar instances can never *alone* give rise to an original idea" (p. 163). Imagination makes it possible for us to *do* the passing from cause to effect or from effect to cause, but does it make it possible for us to *know* that we are doing it?

Hume's thought takes a peculiar turn at this juncture, which plainly makes the idea of causation completely *a priori*, or what Locke would call an idea of reflection, an "impression of reflection," to use Hume's phrase.

> Tho' the several resembling instances, which give rise to the idea of power, *i. e.*, to the idea of causation, have no influence on each other, and can never produce any new quality *in the object*, which can be the model of that idea, yet the *observation* of this resemblance produces a new impression *in the mind*, which is its real model. . . . . Necessity, then, is the effect of this observation, and is nothing but an internal impression of the mind, or a determination to carry our thoughts from one object to another. . . . . The idea of necessity arises from some impression. There is no impression conveyed by our senses, which can give rise to that idea. It must, therefore, be derived from some internal impression, or impression of reflection. There is no internal impression which has any relation to the present business, but that propensity, which custom produces, to pass from the object to the

idea of its usual attendant. This therefore is the essence of necessity. Upon the whole, necessity is something that exists in the mind, not in objects; nor is it possible for us ever to form the most distant idea of it, considered as a quality in bodies. Either we have no idea of necessity, or necessity is nothing but that determination of the thought to pass from causes to effects and from effects to causes, according to their experienced union. . . . . The efficacy or energy of causes is neither placed in the causes themselves, nor in the deity, nor in the concurrence of these two principles; but belongs entirely to the soul, which considers the union of two or more objects in all past instances" (pp. 164–6).

I shall not attempt to do justice to Hume's account of the way in which we arrive at the ideas of continued and independent existence of objects. But the course of reasoning is much the same as that involved in showing how we arrive at the idea of causation. The imagination, in virtue of its propensive quality, already referred to so often, is able to bridge over the gaps between interrupted sense-perceptions, and produce the opinion of a continued existence of body. This opinion is "prior to that of its distinct existence, and produces that latter principle." For belief in the continuity and identity of that which to our sense-perceptions appears only as interrupted fragments, must give rise to the opinion or fiction of the imagination that this continuity and identity is an objective reality, or, rather, "that these interrupted perceptions are connected by a real existence of which we are insensible" (p. 199).

It is in the discussion of objectivity that reason and imagination come to blows again. And the idea of causation has a falling out with the idea of objectivity: (1) Reason tells us that "the doctrine of the independent existence of our sensible perceptions is contrary to the plainest experience. This leads us backward upon our footsteps to perceive our error in attributing a continued existence to our perceptions" (p. 210). The opinion of the identity of interrupted perceptions "can never arise from reason, but must arise from the imagination. The imagination is seduced into such an opinion only by means of the resemblance of certain perceptions, which we have the propension to suppose the same" (p. 209). "The imagination tells us that our resembling perceptions have a continued and uninterrupted existence, and are not annihilated by their absence. Reflection tells us that even our resembling perceptions are interrupted in their existence, and different from each other" (p. 215). Reason, paradoxically enough — reason, which is appealed to only with general rules and conservative principles — suddenly appears to object to imagination's

becoming a lawgiver, a legislator of universal principles. Reason, I should say, appears to feel that its vested rights in the actual data of experience are being threatened. (2) Again, "when we reason from cause and effect, we conclude that neither color, sound, taste, nor smell have a continued and independent existence. When we exclude these sensible qualities there remains nothing in the universe which has such an existence" (p. 231).

Imagination has made possible both the idea of causation and the idea of continued and independent existence — it is the only faculty that makes them possible — yet these two ideas are found to be incompatible. Is it possible that a deep-seated conflict lurks within the very imagination itself? (*Cf.* p. 266.)

SEC. IV. CRITICISM.

At about this point in the discussion, difficulties, contradictions, self-involved criticism, which have been surging below, begin to come to the surface and threaten to wreck all that has been accomplished.

I doubt whether there is in any literature a finer specimen of a confession of philosophic difficulties than the concluding chapter of Book I. In this chapter, and indeed throughout the *Treatise*, Hume makes it so evident what the contradictions are that we are in danger of missing their deeper significance.

The following are brief statements of some of the difficulties and contradictions involved in the *Treatise:*

1. The recurrent doubt as to whether such a faculty as the imagination can furnish the basis of a solid and rational system (*cf.* pp. 198, 217, 267).

2. The ultimate inexplicability of (*a*) the cause of impression — "It will always be impossible to decide with certainty whether they arise immediately from the object, or are derived from the author of our being" (p. 84) — and the ultimate inexplicability of (*b*) causal conjunction. "We cannot penetrate into the reason of the conjunction. We only observe the thing itself, and always find that from the constant conjunction the objects acquire an union in the imagination." (P. 93.)

3. Dilemma between illusion of the imagination and ineptitude of the reason — between false reason and none at all (pp. 267, 268).

4. "Direct and total opposition betwixt our reason and our senses," involving a contradiction within the imagination itself (p. 231). Imagination makes possible both the idea of causation and the idea of continued and independent existence. But when reason employs the former idea, it contradicts the latter. (3) and (4) taken

together have a three-cornered conflict, involving reason, sense, and imagination.

5. "In short, there are two principles which I cannot render consistent: nor is it in my power to renounce either of them, viz., *that all our distinct perceptions are distinct existences, and that the mind never perceives any real connection among distinct existences.* Did our perceptions either inhere in something simple and individual, or did the mind perceive some real connection among them, there would be no difficulty in the case" (p. 636).

6. A final resort to intuitionalism (pp. 164–6 and 629; especially p. 629, Appendix to Book I, Part III, sec. 6, which is too long to quote).

I have said that it was an easy matter to find these difficulties and contradictions, and many others, in Hume's *Treatise*, but it is no easy matter to appreciate their true significance. Perhaps one of their chief functions is to arouse the questioning attitude—*e. g.*, does not Hume end where Spinoza began, namely, with discrediting the imagination as a source of truth? Or, from another point of view, is there very much difference between Hume and Spinoza as to the practical outcome of their systems? What matters it, after all, whether at the start sensations and images be rejected as useless lumber or accepted as foundations, if the outcome and final resort is to be in each case an appeal to a mystic or intuitional sense of immediate contact with reality? What is the use of all this machinery of ideas, sensations, images, emotions, and memories, if it only drives one to a resort where it never has been needed, and never will be? Have the philosophers attempted to discover how this machinery came to be, and what it is really for? This last question seems to me to be aiming closer to the mark than any other. And the nature of a solution of these difficulties and contradictions will be found, I believe, through an inquiry into the origin and evolution of psychological machinery, and its function in experience.

SEC. V. SUMMARY COMPARISON OF SPINOZA AND HUME.

The answers which I find in Hume to the questions proposed at the end of the statement of Spinoza's theory of the imagination are as follows:

1. Manifold, fragmentary, finite particulars and the imagination cannot be identified. The imagination is a unifying activity. It possesses the power of rearranging, of recombining, the particulars of sense-experience which are given to it. The imagination is a plastic,

unifying, *propensive* element in whose flow particulars are held and carried along; transcending the present, it gives us the idea of cause and effect, and of the distinct and continued existence of the objective world. The imagination is not Spinoza's reason or understanding, which sees things *sub specie aeternitatis;* it gives us time, sequence of phenomena, progress.

2. Reason and the imagination are often opposed to one another, but they could not long exist apart. It is difficult, because of the inconsistencies in Hume, to put the point in a more specific form. Part of the time, at any rate, his statements would warrant the inference that reason divorced from the imagination would become absolutely rigid, inaccessible to the molding influence of custom; and that, on the other hand, imagination divorced from reason would become mere fancy. Curiously enough, it is reason with Hume that informs us that our perceptions are interrupted, in this respect corresponding exactly to the imagination with Spinoza; whereas it is the imagination with Hume that gives us the continuity of the objective world to which our interrupted perceptions refer, in this respect corresponding exactly to reason with Spinoza. Yet in another view of the two categories they correspond respectively each to each: with both Spinoza and Hume the imagination is a source of individual variation, whereas the reason can originate no new idea. Reason is a coming to consciousness of laws given either by custom (Hume) or by God (Spinoza). With Hume, however, there appears to be no error necessarily bound up in the spontaneous character of the imagination. To be sure, absolutely undirected by custom or reason, the imagination might become mere fiction. But as it is actually constituted, its spontaneity is rather a propensive quality, an amœboid movement, passing beyond this, that, and the other sense-perception, and leaving behind the formal fixity of reason.

If Hume had completely solved his own difficulties, he would at the same time have answered Spinoza so effectively that further discussion of the matter would be superfluous. The difficulties which he himself recognized are those which some follower of Spinoza, had he been shrewd enough, might have pointed out. Such a follower of Spinoza would probably have begun with that passage in his master's *Ethics* which demonstrates how general ideas arise confusedly in the imagination by means of the agglutination of overcrowded images (*cf.* p. 27); and he would probably have asked how Hume's idea of causation differed from a general idea so formed. He might have

pointed out, as Hume himself did, the contradictory character of the two concepts which the imagination offered to reason — the concept of causation, and the concept of continued and independent existence of objects. And he might have asked whence the validity of any deliverance of the imagination, seeing that it is constituted *ex hypothesi*, not by a universal act of thought, but by particular sense-perceptions, varying in quantity and in quality with every individual.

Still, in spite of the conflicts between these two treatments of the imagination, both agree in one fundamental point; both regard the imagination as conditioned from without, as concerned with particulars given to it ready-made. Only with this difference: Spinoza regards the imagination as that aspect of the mind which is passive with reference to the data imposed upon it from without; whereas Hume regards the imagination as actively recombining its data, as passing from one group to another, as anticipating data not yet actually given. I believe this fundamental assumption to have been the source, to a very large extent, of Spinoza's one-sided conception of the imagination, and of his negation of individuality; and also a source of the difficulties in which Hume found himself — difficulties which any answers to Spinoza's position, in case they flow from the same assumption, are liable to encounter.

From the standpoint of this whole discussion, the chief value of the theories discussed above lies in the problems they suggest to psychology. These problems may be summed up and stated once more as follows:

1. To what extent is the imagination to be held responsible for the detached, fragmentary particulars of experience? (Spinoza.)

2. How far can the imagination be dissociated from the understanding or reason? (Spinoza.)

3. To what extent is the imagination a unifying, anticipating activity? (Hume.)

4. To what extent is the imagination co-operative with reason? (Hume.)

5. Why does the imagination fail to give a firm foundation to a rational system of philosophy — and especially to the concepts of causation and substance, meaning by substance continued and independent existence? (Hume.)

6. Does the imagination simply receive or operate upon ready-made data, conveyed to it through the sense-organs? To what extent is it merely receptive? To what extent is it creative? (Spinoza and Hume.)

PART III.

PSYCHOLOGY OF THE IMAGINATION.

SEC. I. THE USE OF TERMS.

In the interests of division of labor it may sometimes be an advantage to distinguish carefully between the *imagination* and *mental imagery*, according to whether the attention of the observer is directed to the functional or to the structural aspect of the matter. The term "image," moreover, seems to be the more specific and scientific term. Mr. Wilfred Lay, in his monograph on mental imagery, draws a distinction between the terms which is useful because it reflects the distinction commonly made and accepted:

> By imagination is here meant the "faculty" generally called, more specifically, creative imagination. It is that which makes great works of art, whether they be paintings, sculptures, poems, symphonies or cathedrals. The possession of the creative imagination implies that of mental imagery, but not *vice versa*. Imagination is something abstract and indescribable; imagery is concrete and is experienced by every one. Imagination is something that cannot be itself represented in mental imagery save by a feeling; mental images are, on the other hand, quite as real (not objective, however) as sensations themselves, and play quite as important a role in our lives. The association in our minds of the creative imagination with mental imagery is somewhat far-fetched from the real nature of things, and is the result of the similarity and like etymology of the English words which are used for these two aspects of mental life.[1]

If I fail to use this distinction it will be because it seems unreal and fallacious when carried over from ordinary discourse into psychological analysis. It is true that "imagination is something abstract and indescribable"—that is, apart from its embodiment in images or in outward physical forms. It is true that "the possession of the creative imagination implies that of mental imagery." But if we add "not *vice versa*," we are drawing an arbitrary line; we are viewing the matter from the outside, as we must do so often in practical emergencies when we say, for example, such and such people have no imagination, while certain others have. Psychologically speaking,

[1] LAY, "Mental Imagery" (supplement to *Psychological Review*, Vol. II, No. 3), p. 2.

every mental image is creative — creative in the same sense that imagination is creative. To what extent this or that image may modify overt conduct or the arrangement of objects in space and time is a question of becoming aware of a fact; it is not a question of becoming aware of a principle. In making this assertion I am anticipating, of course, a line of argument to be worked out later.

SEC. II. RECENT SPECIFIC CONTRIBUTIONS TO THE PSYCHOLOGY OF THE IMAGINATION.

The great mass of material which has been put at the service of the psychology of the imagination since the investigations of Fechner and Galton were begun has been chiefly of a descriptive character. Images have been contrasted to and compared with sense-perceptions. The imagination has been analyzed into various types — visual, auditory, etc.— each corresponding to a sense-organ. One of the most striking facts that this analysis has brought to light is the wide variance between individuals with reference to the prevailing type of their imagery. As Professor James says: "There are imaginations, not 'the Imagination,' and they must be studied in detail" (*Princ. of Psy.*, Vol. II, p. 50). Abundant and telling evidence of this fact has recently been furnished by the discussions and controversies regarding various types of word-imagery, which have been carried on by Stricker, Egger, Ballet, Baldwin, Dodge, and others. The testimony of Stricker, for example, appears to be flatly contradictory to that of Egger. Stricker describes his internal speech as being purely an affair of articulatory-motor images, as being inseparably bound up with sensations of innervation of his lip and tongue and throat muscles. Egger, on the other hand, describes his internal speech as being purely in terms of auditory images. All this serves to corroborate and give new emphasis to Spinoza's view that the imagination characterizes the individual in his differences from all other individuals.

Attempts have been made, especially by French psychologists, to clothe this bare fact of individual variation with social meaning. Arréat, in his work entitled *Mémoire et imagination: peintres, musiciens, poètes et orateurs* (Paris, 1895), first analyzes memory into motor, visual, auditory, emotional, and intellectual types; then finds a type of imagination corresponding to each, and attempts to show how this varies in nature and development with the aptitude and vocation of the individual. Painters, for example (*cf.* Chap. II) have more definite and detailed visual images, and musicians more systematic

and accurate tone-images, than ordinary men. The intellectual type is feeble in artists, for example, who are by nature receptive and emotional. Still more explicit in the interpretation of individual differences is Queyrat in his work entitled *L'imagination et ses variétés chez l'enfant: étude de psychologie expérimentale appliquée à l'éducation intellectuelle* (Paris, 1895). Queyrat analyzes the imagination into three types —visual, auditory, and motor. His thesis is that predominance of a certain type determines aptitude for science, art, or professional life, as the case may be. Hence it becomes the duty of the educator to discover the predominant type in the child, and thus to direct him intelligently in his choice of a vocation, at the same time developing other types harmoniously. ("La prédominance dans un esprit d'un ordre d'images lui assure des aptitudes prononcées pour une science, un art, une profession. Le rôle de l'éducateur est donc de s'appliquer à la reconnaître, afin, s'il y trouve réal avantage, de possesser l'enfant dans la voie que lui trace la nature" (p. 156).

Further developments in this direction — that is, in the direction of giving an immediate and specific social significance to individual variations of mental imagery — would be in the nature of detailed application. And a thorough test of the hypothesis would involve experiments on children and adults extending over a considerable period of time. I have not been able to learn of any such experiments. Hence the hypothesis can be criticised here only as to its logical merits. The attractiveness of the hypothesis lies in its possibility of affording a positive interpretation of individual variation, by connecting the variation with division of labor in society. The special type of imagery which an individual possesses, especially if he possesses it to an unusual degree, makes him all the more fit, the hypothesis could readily be stretched to say, to discharge some particular function in the social organism. But the hypothesis is broad at the expense of depth. It is as superficial as it is attractive. It is premature. On the face of it, there is no more reason for associating a predominant type of mental imagery with a call to a particular vocation — say the visual type with the vocation of the artist — than there is in associating red hair with a fiery temper. It is true that there may be some deeplying relation between the two; but it is equally true that, until this relation has been made out, the comparison is merely one of superficial and inconstant resemblance — I say inconstant, because inquiries have revealed many exceptions to the supposed rule.[1]

[1] *Cf.* GALTON, *Inquiries into Human Faculty*, pp. 88 and 94. *Cf.* LAY, *Mental Imagery*, pp. 16–24.

Ribot, in his recent and suggestive work on imagination (*Essai sur l'imagination créatrice*, Paris, 1900), criticises the analysis of the imagination into the various types as illusory and futile. Such an analysis, he says, does no more than point out the materials with which the imagination works. It has no more meaning than a classification of architectural structures on the basis of the materials employed; say, a classification of monuments into those made of stone, brick, iron, wood, etc., without reference to differences in style (p. 150). Ribot then proposes the following classification of the principal types of imagination:

1. Plastic.
2. Diffluent.
3. Mystic.
4. Scientific.
5. Practical and mechanical.
6. Commercial.
7. Utopian.

It is not necessary to reproduce his definitions of these types; the essentially social and objective reference of the criterion of the classification is evident. Its value and its limitations fall together. Its value, to say nothing of the richness of detail with which Ribot has illuminated his pages, lies in the truth that the imagination does finally express itself in an objective world of fact. Ribot sums up this truth in the closing sentence of the book: "L'imagination constructive pénètre la vie tout entière, individuelle et collective, spéculation et pratique, sous toutes ses formes: elle est partout." Its limitations lie in the disregard of psychological processes, sensorial or otherwise, that lead up to the objective, overt results; its limitations lie also in the assumption that the sense elements involved in the imagination are so much "material," on and with which the creative powers work. Ribot is also to be classed with Spinoza and Hume, in so far as he regards sense elements merely as the given, the raw stuff, the data of experience.

A conception which, logically speaking, enables Ribot to analyze and classify the various types of imagery on an objective basis, and at the same time to regard the reproduced sense elements as so much "material," is the conception of the motor aspect of imagery. "La nature motrice de l'imagination constructive" is the title of the introductory chapter, and is a theme that reappears again and again throughout the entire work. "Essayons de suivre pas à pas la transition qui conduit de la reproduction pure et simple à la création, en

montrant la persistance et la prépondérancè de l'élément moteur à mesure qu'on s'élève de la répétition à l'invention" (p. 1). Even in a purely reproductory image a motor element is present, Ribot would say, for such an image is a residue of an anterior perception; and perception always involves movements. In virtue of this motor element the image always tends to find outward expression. " . . . . l'élément moteur de l'image tend à lui faire perdre son caractère purement intérieur, à l'objectiver, à l'extériorer, à la projecter hors de nous" (p. 2). But Ribot fails to see anything creative in this tendency of the image to pass into an act. He distinguishes sharply between reprodutive and creative imagination. The criterion is the objective one. The reproductive imagination is that which gives rise only to the repetition of some act or object. To be creative, the imagination must result in something new.

Ribot's work is a contribution to sociology rather than to psychology. Or it might be described as embodying a type of social psychology in which "l'élément moteur" forms a sort of bridge between two sets of phenomena—one psychical or subjective, the other social or objective. Such a conception as this marks an advance over the conception previously referred to—the conception that there is an immediate, qualitative correspondence between certain types of mental imagery and certain activities or vocations. It gives us a glimpse of a mechanism between image and result, idea and fact. I am not attempting to express an appreciation of Ribot's work as a whole, with its clear, though not always convincing, analyses, and its suggestive comparisons. I merely wish to use certain points emphasized in the work; namely, the fact that an image, whether visual, auditory, or tactual, is always motor; and the fact that by virtue of this motor phase an image always tends to objectify itself in the world of fact. And yet there is nothing novel, or strikingly "creative," in these points. They are simply expressions or applications of the current doctrine of sensori-motor and ideo-motor reactions.

What might be called the official work on the psychology of the imagination has not, it seems to me, brought to light results that have a very direct bearing upon the problems raised in our discussion of the imagination as treated by Spinoza and Hume. This cannot be urged as a criticism against the careful descriptive work that has been done, nor against the brilliant interpretations of recent French writers. But a solution will have to be sought in and through other phases of psychology.

SEC. III. A PSYCHOLOGICAL ANALYSIS OF IMAGE-DEVELOPMENT.

In this part of the discussion I am especially indebted to Professor Dewey's reinterpretation of the doctrine of sensori-motor reaction, as found notably in his article on the "Reflex-Arc Concept in Psychology" (*Psychological Review*, Vol. III, p. 357).

The fundamental assumption with Spinoza and Hume — and with Ribot as well — the assumption that the sense element in experience is externally imposed, is a datum; an "impression," to use Hume's word; "material," to use Ribot's — suggests the point at which analysis may be most effectively directed. If the assumption be granted, then we have either of two alternatives presented, according as we regard the recipient "faculty" of the mind as passive respecting its data, or as active. With Spinoza we may regard it as passive, and the problems already indicated (p. 48) will arise, the most pressing of which is perhaps the problem of individuality. What can be done for a self that is half bond and half free — half imagination and half reason? Is it a self at all? It takes a thoroughgoing empiricist, or associationist, like Herbert Spencer, for example, to push this conception past Spinoza and on to its logical ultimatum, completely generalizing the method of forming the individual out of a continual raining in of sense-impressions — but at the expense of a complete dissipation of individuality. Spinoza was a semi-Spencerian. Or with Hume we may regard the imagination as actively recombining and projecting its sense data; and another set of difficulties will arise, chief among which is the wholly irresponsible character of the imagination thus conceived apart from its material. In short, the assumption, in whichever way it is taken, creates more difficulties than it solves.

A counter-assumption which I wish to test on this group of problems is the assumption that a sensation is not a given element, a datum, but appears as the *locus* of a problem. It marks or locates the point in the organic activity of an individual where the strain is greatest, where demand for readjustment is most acute. A sensation is the way in which strain *seems* to the individual — in that sense it is seeming rather than being. It is the appeal which the demand for readjustment makes to the individual — in that sense it is particular rather than universal. It does not presuppose organic activity as a *basis*. It is organic activity come to consciousness in the process of becoming more organic. The so-called reflex arc is not sensori-motor or ideo-motor, in the sense that it is made up of two joints or segments, one of which is sensory up to a certain point, and the other motor. The

"reflex arc," or, as it has been more aptly termed, the "organic circuit" of stimulus and response, is either all sensory or all motor, depending upon whether it is a matter of immediate experience, or a matter of mediate or inferred experience; depending upon whether it is my experience from my point of view, in which case it is sensory; or my experience from your point of view, in which case it is motor. A kinæsthetic sensation is as much a sensation as a visual or auditory sensation. And, conversely, a visual sensation involves motor adjustments as much as a kinæsthetic sensation.

To say that a sensation appears as the *locus* of a problem does not mean that every sensation is to be so regarded. A sensation may be simply the point of least resistance in some habitual attitude or response which is anything but problematic. The barking of a distant dog breaks in upon my stream of consciousness as I write these lines. Since I have no jurisdiction whatever over that dog, the barking is barely perceived; in other words, only the most habitual and elementary forms of auditory perception and interpretation are brought into play. The case might be very different, however, if I knew that I could exercise some sort of control over the dog. In that event I might allow myself to be irritated by the barking. The more I felt that it was in my power to do something to check the disturbance, the more the sensation in question would appear to be the *locus* of a problem. The rattling of a window, the flapping of a curtain, the squeaking of a sign-board, are often almost entirely ignored, until it occurs to one that something can be done to stop the noise; then, unless the suggestion is followed up without delay, the noise is liable to become a source of irritation, a *locus* of a problem. I doubt whether Carlyle had been so much disturbed as he was by the cackling of his neighbors' fowls, if there had not been some suggestion, however remote, of the possibility of Mrs. Carlyle's purchasing the offenders, as she finally did, and silencing them forever. Instead of its being true that a sensation is a datum given from without, it is more true to the facts of experience to say that when a sensation is so regarded it is liable to be annihilated. Wholly from without? Well, then it does not concern me; I can't help it. It is only when I feel myself to be in some way responsible for a sensation; it is only when it arises within my range of activities, my habits of control, that it persists and grows more intense.

The greatest difficulty that stands in the way of this assumption or hypothesis as to the nature of sensation would seem to be the objection that it is absolutely idealistic — if sensation is not given from without,

then it must be given or produced from within — purely idealistic, subject to call, so to speak, and therefore not in any degree problematic. This difficulty or objection is really nothing but the same old assumption over again, though in an apparently new form. It arises because of the old tendency to deal with sensation as if it were a datum, if not given from without, then, forsooth, given from within. If the externally given sensation is to be regarded as materialistic, and the internally given sensation as idealistic, then from the standpoint of the present hypothesis it is a matter of complete indifference whether a materialistic or idealistic turn be given to the machinery. The present hypothesis simply takes sensation where it finds it, and attempts to give it a functional interpretation. One of the commonplaces of psychology is that sensation cannot be defined save in terms of itself. Carry this commonplace farther and the definition may be reached that sensation is, functionally, simply experience defining itself to itself.

It may relieve the last statement of some of its metaphysical abstractness to consider the classification of sensations employed by several modern psychologists, notably by Külpe. By him sensations are classified into those peripherally excited and into those centrally excited, or into sensations as such, and images or ideas. This distinction between peripherally and centrally excited sensations seems to be made on a purely structural or even anatomical basis. Sensations peripherally excited are psychical phenomena which necessarily involve the stimulation of a sense-organ. Those centrally excited are psychical phenomena which necessarily involve the activity of some portion of the central nervous system, but not necessarily the stimulation of a corresponding sense-organ — the phenomenon may be experienced even though the sense-organ is no longer in existence. The distinction does not deny the primary unity of the two sides, nor their subsequent interdependence, but it does assert that they may become anatomically distinct from one another. Yet, being a structural or anatomical distinction, it may furnish the *loci* for a functional restatement. It suggests a division of labor, as well as a difference of position. Even in its present form it is a criticism upon the traditional view, held by Hobbes and his successors, that a mental image is a less vivid or decayed sense-impression. "The correctness of the assumption that images are merely weaker sense-perceptions has never been demonstrated," says Külpe, "and the constant assumption has done as much as anything else to render the department barren and schematic" (*Outlines of Psy.*, p. 169). But *any* structural statement lays itself open

to just such a criticism as this. It has to be supplemented, and possibly corrected, by a functional or physiological statement. How did the two *loci* or *foci* of sensation arise? What is their function in maintaining the life-process? Under what conditions does an "organic circuit" become an organic ellipse?

The problem can be most readily approached, I believe, from the genetic and physiological side.

It is a law of growth, on the physiological side, that habits previously worked out independently of one another shall be combined, co-ordinated, to form a higher, more organic unity, which in its turn may become a habit, subject to combination with other habits; and so on indefinitely, or until growth ceases. This form of combination is not a mechanical putting together; it is organic, since each member of the co-ordination, each previously independent habit, undergoes reconstruction and also gains in efficiency through its interaction with the other members of the co-ordination. To illustrate, take the case of learning to swim. There are habits of pushing objects aside with the hands and arms, habits of kicking, habits of balancing the body, etc., which have been worked out independently of one another, at least so far as the act of swimming is concerned. They are the necessary constituents of the act or habit of swimming that is to be; but simply making them work together is not sufficient; they must be co-ordinated. Each habit has to be made over somewhat, reconstructed, through its interaction with the other habits involved. Each gains a new efficiency, in proportion as the act of swimming is mastered — as the co-ordination is realized. And this co-ordination, when realized, tends to become a habit, capable in turn of playing a part in some larger co-ordination yet to be.

Two distinct factors of this law of growth are habits and co-ordination; and bound up with these is consciousness. Between habits, the achievements of the past, and co-ordination, the possibility of the future, stands the "specious present" of consciousness. Out of this "specious present" of consciousness with reference to habits on the one side, and to co-ordination on the other, arise the two *foci* of sensation, the peripherally and the centrally excited sensations — sensations as such and images or ideas. Sensations as such answer to habits, which are not quite what they were, because they are conflicting or inadequately functioning under the stress of unwonted conditions. The image answers to the co-ordination that is to be, provided it is possible to anticipate the co-ordination.

As to the possibility, on the physiological side, of anticipating a co-ordination. The sensory areas or centers of an infant are unco-ordinated. According to Flechsig, the mechanism for their co-ordination is lacking until the medullary sheaths of the connecting fibers or association centers ripen. "Noch einen Monat nach der Geburt sind die geistigen Centren unreif, gänzlich bar des Nervenmarkes, während die Sinnescentren schon vorher — ein jedes für sich, völlig unabhängig von den andern — herangereift sind" (*Gehirn und Seele*, p. 23). Until the connecting fibers ripen there is no reason to suppose that the eye activity, say, influences in any organic way the hand or ear activity, unless it be through some subtle modification of that dark continent of inner environment, the blood supply. Naturally only random movements and instinctive acts are possible. The fingers close in response to a stimulus of the palm. In the same way, probably, the muscles of the eye respond to a stimulus of the retina. But neither hand nor eye movement can affect each other organically, until the nerve-fibers connecting the eye and hand tracts become functionally mature and active. It seems probable that each type of movement develops as far as its isolation will permit; but it is difficult to conceive how anything corresponding to a mental image could arise during this period. With the ripening of the connecting fibers, however, comes the possibility of the image. The eye-hand activity which now arises is a more complex activity, and one capable of a higher degree of organization, than either the eye or the hand activity by itself. At first each activity is an accidental stimulus to the other; it shoots into the other, so to speak, at random. Only through such chance associations, followed by repeated trials and interaction, does the higher organization of the eye-hand activity come into existence and establish itself. In the case of the painter, to take an extreme example, this process of perfecting the organization of the eye-hand activity may be the work of a lifetime.

The *Anlage* of the image thus approached from the genetic and physiological side is capable of being generalized and of having its mechanism stated in the following terms: At first, as I have already pointed out, the activity takes place in a wholly unanticipated, accidental way. There comes a time, however, with reference to a given stimulus, when a tension is bound to arise between the eye and the hand activity as independent reactions and the eye-hand activity as a co-ordinated reaction. It is not that the original eye activity is opposed to the original hand activity as such. But it is a conflict between the old way of doing things, represented by the instinctive

reaction of the eye activity as independent and the instinctive reaction of the hand activity as independent, and the new way of doing things, represented by the eye-hand co-ordination. In describing this tension we are at the same time describing consciousness, and also, what is more to our purpose, the origin and function of the image in its relation to sensation. (I am using the terms "image" and "sensation" as equivalent respectively to centrally and peripherally excited sensations.) The image is the incipient eye-hand co-ordination in its tension with the incipient eye and hand reactions. The image stands for the persistence of previously haphazard co-ordinations; the sensations stand for immediate eye and hand reaction. The image is the incipient eye-hand co-ordination in its tension with the incipient eye and hand reactions. The sensations are the incipient eye and hand reaction in tension with the incipient eye-hand co-ordination. (I am not using the terms "co-ordination" and "reaction" to mark a radical distinction. Co-ordination is simply a more complex, more mediated reaction. Reaction denotes the more direct and immediate response.) The greater the tension, the more comprehensive the image, and the more definite the sensation.

Professor James, in his chapter on "Will," has shown how all voluntary action is a function of the image or sensation attended to, though it seems necessary to him to postulate in addition a *fiat*, a sort of "le roi le veut." Our hypothesis can accept and utilize *in toto* Professor James's analysis of the mechanism of volition without at the same time being obliged to use the remnant of monarchy which is bound up in the doctrine of the *fiat*. Activity is a fundamental characteristic of the self. The problem is how this activity shall be organized and expended. The image is the element of control as against sensation or tendencies to immediate response. It represents a more adequate mode of freeing activity as against merely impulsive or instinctive action. Yet both image and sensation appear as the problematic points in the situation. The co-ordination can be expressed only through the reconstruction of relatively partial reactions. On the other hand, in asserting themselves as sensations these reactions at the same time define the condition which the more highly organized activity must meet and utilize. The process of consciously reconstructing previous types of reaction, and the tension between co-ordination and reaction which appears as a conflict between two sets of sensations — centrally and peripherally excited — are equivalent expressions. The activity which reconstructs, or which defines itself to itself in sensations, or which finds expression in overt movements, is one.

I have implied that the image is the persistence of previously haphazard co-ordination. This would seem to mean that the image is simply a revival. Taken in itself, this would be true, but the image is not to be taken in itself; it has to be taken in its relations, in its tension, to previously isolated reactions. With reference to them it is not a revival; they are rather the revivals. It is an anticipation of a fuller and freer activity into which these previously isolated activities may pass, and find organic membership.

It will be seen at once how close this is to the view which Hume took of the imagination. The value of Hume's analysis with reference to this point has not been recognized, and can hardly be overestimated. The "propensive," projective, anticipatory character of the image — that is precisely its function, as Hume clearly saw. It is interesting to recall, in passing, Spinoza's identification of the imagination with the gift of prophecy. True, Spinoza placed the emphasis on the receptive, sense-content aspect of the imagination, rather than on its forward, anticipatory movement. And yet, if prophecy deserves the name, it is a *fore*telling.

We cannot rest the case, however, on this somewhat speculative attempt to approach the problem from the genetic and physiological side. It was simply an attempt to get the benefit of a view of the matter from without before looking at it from within; before looking at it as it appears in the individual's stream of consciousness; that is, before approaching the problem from the psychological side. Doubtless it would be either gratuitous or else "metaphysical" to develop the point which underlies this discussion, namely, that these two sides, the physiological and the psychological, have little or no significance apart from one another, and that both are abstractions arising in one activity, in one life-experience. The point more relevant to this discussion is concerned with how the relations between sensations and image are experienced; and finally, what is the consciously experienced relation between what we call the imagination and reason. This is not to be concerned with how sensations are received from things, nor how "brain paths" are wrought — these are questions rather of psychophysics or of metaphysics — but the problem is to take sensations and images as we find them and to seek what is their function in experience. This is in harmony, I believe, with the attitude taken by Locke when he said, at the beginning of his *Introduction:*

> I shall not at present meddle with the physical consideration of the mind; or trouble myself to examine, wherein its essence consists, or by what motions

of our spirits, or alterations of our bodies, we come to have any sensations by our organs, or any ideas in our understandings; and whether those ideas do in their formation, any, or all of them, depend on matter or no: These are speculations, which, however curious and entertaining, I shall decline, as lying out of my way in the design I am now upon. It shall suffice to my present purpose, to consider the discerning faculties of a man, as they are employed about the objects, which they have to do with.

"To consider the discerning faculties of a man," and to consider them with reference to the carrying on of the business of life, whatever that may chance to be, or "as they are employed about the objects with which they have to do," is to be concerned with a psychological problem close to the one we now have in hand.

I shall try to be brief, for the points I wish to bring to attention are too obvious to need extended treatment; they are all on the descriptive rather than on the explanatory level.

1. The experience of a sensation of some kind is essential to the carrying on of any habitual activity, and *a fortiori* of any unaccustomed activity. By habitual activity I mean an acquired or learned activity, one that has passed through the readaptive process of consciousness, such as walking, writing, etc.; and I would exclude, of course, all purely reflex, automatic, and instinctive acts. The latter are rather the raw materials, if they are not the finished products, out of which habits are constructed.[1] The need of sensations in the forming of a new habit is too patent to require more than a mere mention. But the need of sensations in carrying on some well-established habit is sometimes in danger of being overlooked, because the sense factor may be so "remote," to use Professor James's word, so reduced in character, as to lose itself in the "fringe" of consciousness. Take, for example, the habit of writing, the habit of forming verbal symbols in script. It is only necessary to close the eyes while using the pen to note how dependent the habit is upon the visual sensations of the materials and movements involved. Professor Baldwin's analysis of handwriting, in *Mental Development, Methods and Processes*, is especially instructive as to the details of this illustration.

2. Granted that a sensation of some kind, no matter how remote and reduced—it may even be of the kind that is "centrally excited"—

[1] It is not intended to discriminate rigorously between automatic reflexes and habits; nor, on the other hand, is it deemed essential to the argument to reckon with the possibility of habits shading into reflexes. It is not a question of terms or of nomenclature. A habit may continue to be called a habit, if anyone likes, even after it becomes completely automatic, or operated by stimuli that do not rise above the threshold of consciousness. The aim of this part of the discussion is simply to indicate a functional relation between sensations and habits, or acquired co-ordinations — some habits, if not all.

is essential to the carrying on of a given habit, it is to be expected that in a specific case the absence of the appropriate sensation or sensations will render impossible the functioning of the habit. The reaction, if it takes place at all, will fail of the sureness and smoothness of the habitual reaction; it will tend to become wavering, spasmodic, too intense or too feeble, as the case may be. Either a new habit has to be worked out with reference to the sensations or stimuli actually present, or else the appropriate stimuli have to be discovered. *An important function of the image is to direct the search for the appropriate stimuli.* It is quite possible, I repeat, that when the appropriate stimuli are absent, a new habit may be formed with reference to the stimuli actually present; but this is liable to involve a long and conscious interruption of some process more or less essential to the life of the organism. If, when the interruption is first felt, an image comes to consciousness which reveals the appropriate stimuli in their association with the present situation, a search may be undertaken for the stimuli and the habit administered with due economy. The so-called laws of the association of ideas—contiguity, similarity, contrast, cause and effect, and the rest—are the mechanism of which the image is the definition, the specific instance, in directing the search for the stimuli appropriate to the functioning of a given habit. In the presence, then, of the interruption of some habit through the absence of appropriate sensations or stimuli, the image comes in as a more adequate representation of the situation than the immediate sense-perceptions can afford, as a filling out of the incomplete, the imperfect, and as a means of selecting or passing to the appropriate stimuli. It is possible, also, for the image to reveal the impossibility of selecting appropriate stimuli, and hence the necessity of reconstructing the habit or of working out a new one.

Suppose, for example, that, as I am writing these words, the supply of ink in the fountain pen suddenly gives out. The writing habit suffers interruption, not only because the movements of the pen will no longer leave a record that will be apparent to some possible reader, but because the writing movements themselves are dependent in a measure upon the visual sensations of the ink tracings that follow the pen. Even if I were to slip a sheet of carbon paper under the paper on which I am writing, so that a record could be obtained which should be visible to a possible reader, though not visible to me at the time of writing, I could not proceed as before. The look of the letters and the words as I write not only facilitates their comparatively regular

and legible formation, but also assists in the arrangement of the larger units of the sentence. Doubtless the habit of writing in my usual hand with a dry pen over carbon paper could be acquired without much expenditure of time or energy, but we will suppose in this case that it is neither necessary nor desirable. We will suppose also, for the sake of the illustration, that the ink bottle is not immediately at hand, and that the filling of the fountain pen has not become a purely habitual part of the writing act. The point is that the search for the ink bottle is directed by an image, if it be in any sense a conscious search. The image may be simply a vague feeling of tendency in a certain direction where the ink bottle is likely to be found, or, especially in the presence of unsuccessful efforts to find it, the entire contents of a shelf, or of a room, say, may be vividly imaged in the attempt to locate the missing article.

3. The sensations that have to do with the carrying on of habits are for the most part those lying in the "fringe" of consciousness. We have now to speak of sensations that lie in the focus of consciousness, and of the relation of the imagination to them. The function of sensations of this order has been implied under 1 and 2. The interruption of a habit through absence of appropriate stimuli brings at the same time certain stimuli to consciousness which may have lain far below the threshold of consciousness. But the more palpable cases are those that arise in the interruption of a habit through conflicting habits, or through unusual and inappropriate stimuli. In such cases it is not so much a question of discovering the missing stimuli so that the old habit may go on, as it is of reconstructing the habit to meet the new demands of the situation. In all cases of interrupted habitual activities the sense factor locates the interruption, the strain, with reference to which a new adjustment has to be made. Take the case, for example, of a man who is about to make a speech before a large audience, and who is wholly unaccustomed to such an ordeal. Few under such circumstances would be fortunate enough to escape the distracting sensations that swarm to the surface of the stream of consciousness, coming from the lower regions of throat, lungs, heart, and diaphragm, and all indicating the interruption, the breaking up, of the speech habits and others, under the stress of unwonted and inappropriate stimuli.

4. It is possible that new adjustments may be worked out solely in the medium of peripheral sensations, without involving an image. But unless backed up by well-defined instincts, such a method of

acquiring new adjustments is laborious and expensive, judged by the usual standards. Each new movement in the process has to be made haphazard, without anticipation of probable consequences; and the successful adjustment, when finally reached, is likely to represent the survival of a few fit and elect responses, over and above the many unfit and condemned. It is a case of the adage: "Experience is a hard school, but fools will learn at no other." True, no new habit or adjustment can be learned save through random and haphazard responses. But the fact should not be overlooked that, in the case of children, the environment, or stimuli, is controlled by their elders, so as to limit the range and direct the play of these random and haphazard responses, the result being that the child learns through the experience of the race as well as through his own experience; and that, in the case of the more mature, models of various kinds, to say nothing of the imagination, play their part in economizing effort. New habits and adjustments may be acquired, to repeat, solely through the medium of the sensations, but in the interests of greater efficiency and economy the imagination enters as a factor.

What is commonly termed learning through imitation lies between learning through merely immediate sense-perceptions and learning through the imagination, and may properly be considered by way of an intermediate step in the discussion. The model imitated, particularly if it be not a finished thing, but a process of making or doing something, performs the function of selecting stimuli for response on the part of the learner. It tends to limit the range and direct the play of his random and haphazard impulses. The model imitated does not have to be, of course, an immediately present external thing or process. It may be a memory image of the thing or process. Most of the plays of early childhood afford illustrations of how new habits are acquired through imitating a model held in the form of a memory image. (I am using the expression "memory image" in the sense in which Hume uses the expression "idea of memory," meaning a pretty literal reproduction of the sense "impression," rather than in the sense of an image consciously referred to the past.) The memory image functioning in this way is psychologically creative, in that it is instrumental in the forming of new habits and adjustments.

But there arises a demand for greater efficiency and economy than that realizable through imitating either an external model or a memory image. Every break or interruption of the course of a habit is a unique event. The crisis will be met most economically if the

resources of the past experience of the individual, not of anyone else to the exclusion of his own, be brought to bear. No memory image will meet the situation most effectively, because the situation is new; it is a break in the habitual. It must be an idea of the imagination, to use Hume's expression — an image which reconstructs and projects the old to meet the new.

Modern drama and fiction are rich in illustrations of this point. The plot conflict frequently centers about the success or failure of some dominant idea of the imagination, as conceived by some individual, to meet the situation. We are not interested, as a rule, in how successfully one character may imitate another, except in burlesque; but we are interested in how a character faces a difficulty, a break in the course of his career, a problem; and we follow eagerly his attempt to bring his own resources to bear, whether he be a Prospero, winning almost perfect triumph through the range and power of his ideas, or a Caliban, almost entirely at the mercy of his own impulses and external circumstances.

To sum up the points made on the physiological and on the psychological sides:

1. The *Anlage* of the image, the physiological condition, comprises the association fibers connecting the various lines of sensori-motor activity. To say that the association fibers connect various brain-centers might be misleading, unless it be understood that in connecting centers they are also connecting peripheries. It is the whole sensori-motor activity, including sense-organ, nerve-fiber, muscle, or gland, that is connected with other sensori-motor activities by means of the association fibers. Even this is possibly misleading, as implying that the association fibers are somehow external or adventitious to the sensori-motor activities. The co-ordination of various sensori-motor activities, of which the association fibers are the physiological mechanism and the image the conscious representation, is, so to speak, a "union loop," constituted by the various sensori-motor lines.

The image arises in the tension between the new co-ordination and the older, more immediate, sensori-motor reactions.

2. On the psychological side the image comes to consciousness as the means for directing a search for stimuli or sensations appropriate either to the carrying on or to the reconstruction of a habit which has been interrupted, either through lack of appropriate stimuli or through the presence of inappropriate stimuli and conflicting habits or impulses. The image may be either a memory image — in other words, a reproductive or imitative image — or it may be a reconstructive image,

an image of the imagination — to put it tautologically. But in either case it is a creative image, in that it modifies the response — continues the functioning of a habit or directs its reconstruction.

Putting the physiological and the psychological sides together, we note that the image is not simply a faded copy of sense-impression, and that the imagination is not simply either the passive recipient or the arbitrary manipulator of so much sense-material given from without; but that the image is a conscious anticipation and selection of the conditions that will free impulses and organize them into useful habits, representing as it does a co-ordination of sensori-motor reactions; and that the co-ordination of sensori-motor reactions becomes effective as a co-ordination, because it does anticipate and select stimuli that are essential to its realization, and is not dependent solely on the reactions and stimuli immediately present.

It is evident, I presume, that an assumption which underlies this discussion is concerned with the nature of habit. I do not propose to argue the assumption here, but merely to mention it. No attempt is made to go back of habit into original instincts and impulses, because it seems probable that in the process of transforming instincts and impulses into habits the image plays little or no part; the transformation is assumed to take place through the medium of sensations, the instincts standing for ready-made, inherited co-ordinations — unconscious images, to put it paradoxically. In this discussion the existence of habits is taken for granted, and we are concerned with habits which do not function wholly below the level of consciousness, but which require some conscious element, sensation, or image, no matter how remote or reduced. The function of the image is to economize the process of transforming one habit or set of habits into another. A habit is an adjustment to a relatively fixed environment, or set of stimuli. But the environment moves on; new conditions arise; new demands have to be met. The habit is interrupted. The various sensori-motor reactions involved in a habit are shaken loose, so to speak, like strands of a broken cable. The points of interruption, of strain, are located by sensations. The reconstruction of the habit to meet the new conditions may be made through the medium of peripheral sense-experience exclusively, but only at a wasteful cost of time and energy. The function of the image is to diminish this cost of time and energy through anticipating and selecting stimuli appropriate to the reconstruction of the habit. This habit has not functioned hitherto as a separate thing. It is part of a co-ordination, part of what

is sometimes called a "bundle of habits." The image is this fact come to consciousness. The image anticipates only as it retrospects. It is *pro-pensive*, to use Hume's word, only under the momentum of past experience.

There remains to consider the relations of the imagination to reason, a problem set both by Spinoza and by Hume. With both, the imagination and reason are, finally, incompatible categories. True, as I have already pointed out (pp. 47 ff.), Spinoza and Hume do not agree as to the function and value of these categories. It is reason, according to Hume, that informs us that our perceptions are interrupted (in this respect reason corresponding exactly to Spinoza's definition of the imagination); whereas it is the imagination, according to Hume, that makes possible an idea of the continuity of the objective world, to which our interrupted perceptions refer (in this respect corresponding exactly to Spinoza's definition of reason). This very transposition of terms only brings out more clearly how both were at this point grappling with the same problem — the old problem of the one and the many. It is a case where transposition of terms does not alter the balance of the equation which states the problem. Rather is it where they most nearly agree in the use of terms that they differ most widely in meaning and in form of solution. Both agree that the imagination is the essence of individual variation. But with Spinoza this locates the source of error and confusion; whereas with Hume this locates the last resort, if not for truth, at least for the possibility of truth. Both agree that reason can originate no new idea. But with Spinoza reason is a way of becoming conscious of laws given by God; whereas with Hume it is a way of becoming conscious of laws given by custom. Both agree that the materials of the imagination are sense data given from without. But with Spinoza the imagination is conceived as passively receptive; whereas with Hume it is conceived as actively manipulating and recombining its data. Even in their apparently final and complete agreement that the imagination and reason are incompatible, Spinoza proposes the absolute exclusion of one category, the imagination, from the realm of philosophy; whereas Hume continues to keep house with both on his hands.

I think we are prepared to recognize that from a psychological point of view the imagination is not always compatible with reason. The imagination has the defects of its qualities. Its characteristic function of transcending the immediately present, in order to direct

the search for stimuli appropriate to the continuance or reconstruction of essential habits, demands a certain range for free play which may, particularly in the event of failure to discover the appropriate stimuli, be converted into license. The so-called laws of association — contiguity, similarity, and the rest — which are the mechanism by which the resources of past experience are brought to bear on a particular situation, may, especially in the case of failure, continue to run on their own momentum, one idea calling up another, in a sort of endless chain of mind-wandering. The energy which should have been directed toward meeting the concrete situation and in forming practical habits of conduct becomes diverted into mere play of mind, into mere day-dreaming. Action, instead of being controlled through ideas, is postponed for the sake of the satisfaction that attends the flow of centrally aroused sensations. When the actual conditions of action are lost sight of — which is only another way of saying that the peripherally excited sensations are ignored — the play of imagery runs away with itself; it becomes capricious, untrustworthy, and misleading. To use a mathematical comparison again, the imagination which first emerges as one of the foci of an organic ellipse may become parabolic, and even hyperbolic.

And yet it does not cease to be a function of the cone of experience. It is precisely at this point in the analysis that the adequate idea, or reason, is seen to have its place. The adequate idea, or reason, is the deeper principle of habit or control which lies back of the play of imagery. It is the idea which is adequate, equal to, a match for, the demands of the actual situation. In a sense, it is older and more fundamental than the imagination, for it is the side of response which is present in the first instinctive reaction. But at the same time it is one with the imagination, being the imagination as controlling most effectively the given situation through the free play of its own resources. Reason is the imagination in focus, both in the physical and in the mathematical sense of the word.

It is significant to note that comparatively little imagery is associated with reason. A concept or an idea, or a purely intellectual process, is described as a pale, washed out, abstract thing, in contrast with the rich, sensuous content of the imagination. It is usually taken for granted that the imagination is somehow closer to sense-perceptions, more of the earth, earthy; whereas concepts, ideas, reason, are more remote, transcendent, spiritual. It is quite possible that the negative virtues thrive with most safety to their possessors in the soil

of reason; for a negative virtue planted in the soil of the imagination is liable to become a luxuriant vice. From a psychological point of view, however, there is no distinction of value between reason and the imagination. The distinction between the two is one of sensuous content, as has just been indicated, and this is to be interpreted as one of function. A concept, like a habit, is carried on, is consciously controlled, by means of a sense factor, which is usually exceedingly remote and reduced. In the case of a concept the sense factor is centrally excited; in other words, an image. In the case of a habit the sense factor is more frequently peripherally excited; in other words, a sensation. But even this distinction between concept and habit is rather arbitrary. By either is meant a consciously acquired process which is carried on with the minimum of conscious attention. Reason, as Hume pointed out, is not engaged in originating new ideas. Neither is habit. Their business is to continue the functioning of those already originated and worked out. It is true also, as Spinoza pointed out, that reason is adequate. It is the adjustment so completely worked out, so equal to, so adequate to the situation, that it is functionally one with it. Within the province in which it works reason's control, the control of the adequate idea, is supreme. What wonder that a philosopher should wish to make that province the universe, or the universe that province!

An idea of the imagination, however, represents control as ideal, not as fact. It represents a possible process of reconstructing adjustments and habits; it is not an actual adjustment. Its sensuous content is richer and more varied than that of reason, for only in this way can it anticipate conditions and bring about responses in the process of learning the new adjustment. It arises normally in a stress, in the presence of fresh demands, and new problems. It looks forward in every possible direction, because it is important and difficult to foresee consequences. But suppose the new adjustment to be made with reasonable success — reasonable, note. Suppose the ideal to be realized. With practice the adjustment becomes less problematic, more under control — that is, it comes to require less conscious attention to bring it about. The image loses some of its sensuous content. It becomes worn away, more remote, until at last it becomes respectably vague and abstract enough to be classed as a concept. The imagination, then, is the essential reconstructive process between habit and habit; between concept and concept; between reason and reason.

If control be anything else but self-control, then reason and the

imagination are incompatible. Reason becomes the outer, external law, fate, custom, or substance, to which the individual must conform or perish; and the imagination becomes the unseen caprice, the idle, self-deceptive dreaming, of the unregenerate individual. But if control be won through conscious effort and maintained through conscious experience, then the imagination and reason are simply stages in one process.

APPLICATIONS AND CONCLUSION.

It is apparent, no doubt, that the psychological analysis of the imagination which has been undertaken above is closer to Hume than to Spinoza. How is it to avoid the difficulties that confronted Hume's analysis of the same faculty? Or, if we may cast the burden of the proof upon Hume, why the difficulties that arose in his attempt to make the imagination the carrier of the ideas of causation and of substance? We cannot lay the blame of all of them to his doctrine of sense-impressions, and images derived after the manner of Hobbes from sense-impressions. Such a doctrine might even dissociate mental imagery from the body of sense-impressions so far as to make one the mere ghost of the other; and yet, if the imagination does work in an orderly and progressive manner, it might still be described as the carrier of the ideas of causation and of substance; just as ghosts might be conceived of as rational beings dwelling in a real world like the gods of old, and influencing the course of events in harmony with the decrees of fate. Not metaphysical difficulties so much as actual psychological difficulties stared Hume in the face and were frankly acknowledged. The imagination is not always orderly and progressive. It is often capricious and ambiguous. Hume saw that the imagination is the distinctively subjective element; a potency, not a resultant; anticipating, prophetic — to recall Spinoza — not predetermining. And yet it was at the same time the only element left to Hume which could carry anything. It was the only element possessing the quality of continuity and capable of transcending the present moment. Hence it was loaded down with those great objective categories of causation and substance; and, mere ghost that it was, it broke down under the strain.

The image comes to consciousness in the conflict between tendencies to action. The presence of the image marks the stage as incomplete, as an experience in the process of being transformed, reconstructed. Taken in itself, the stage is but a cross-section of a given situation; not the complete experience that is to be. To regard such a stage as complete in itself is to mistake a part for a whole, a function for a structure. It is true that this stage is no mere abstraction from the sense-elements of experience, as many of the older

psychologists would have us believe; even in its earliest and crudest form it is a kind of rehearsal of the performance that is to come later. As a rehearsal it has to be as absorbing as the performance itself; and, though on a reduced scale, it may give as full a sense of power and of satisfaction. But apart from the performance it is meaningless. It is incomplete in itself. *The real test of a rehearsal is always the performance.* And, furthermore, the character of the performance will determine the *foci* of attention in a subsequent rehearsal.

The weakness in Hume's theory of the imagination lay in its failure to locate the test of truth in action itself. The imagination is but the half-way house on the road to this destination, and is not the permanent abiding-place of the objective categories of causation and substance. It can be held responsible only in and through the action that emerges as the expression of its anticipatory function. It is true that the imagination involves in its activity the use of the categories of causation and substance, just as a rehearsal of a drama involves the stage itself; we can go farther and say that in the activity of the imagination, or in the tension that this activity represents, these categories come to consciousness as the conditions of action and take on new meaning; just as in the rehearsal of a drama the stage, its machinery and accessories, receive a larger share of attention, it may be, than in the actual performance. But the imagination cannot on this account be conceived as the sole carrier of these categories. In the imagination these categories *represent* the conditions of action. In the forthcoming experience, in the performance itself, they *are* the conditions of action.

By way of final application of the points brought to attention in the psychological analysis undertaken above, let us return to the summary of problems on p. 48.

1. To what extent is the imagination to be held responsible for the detached, fragmentary particulars of experience? (Spinoza.)

Compared with reason, as has already been pointed out pp. 68–69, the imagination is much the richer in sensuous content, because it represents the conscious attempt to control the making of a new adjustment or habit, whereas reason stands for the acquired adjustment. In this sense the imagination is responsible for the particulars of experience, that is, it brings them to consciousness in the process of directing a reconstruction of experience. Nevertheless, in this conscious attempt to control economically the making of a new adjustment or habit, the imagination can at best only approximate the selection

of the appropriate stimuli. It must of necessity include as well stimuli that are not appropriate. Its forecast is more or less problematic. There is truth, therefore, in holding the imagination responsible, as Spinoza does, for the detached and fragmentary particulars of experience. It is only when the imagination is viewed as a faculty which passively receives impressions from without, that this characteristic becomes a consuming fault. Once let the imagination be viewed, not as passively receptive, but as a recombining, anticipatory, "propensive" faculty, and this characteristic is seen to be responsible rather to the novelty of the situation which the imagination is attempting to meet, than to any inherent flaw in the faculty itself.

2. How far can the imagination be dissociated from the understanding or reason? (Spinoza.)

From a psychological point of view, that is, from the point of view of the analysis of experience as maintained by the individual, the two cannot be dissociated. They are different stages in one rhythmic process. They are as essential to one another as any two things that are polar. Reason is the side of acquired, organized control; it is the *ratio*, the well-devised and tested plan. In a universe that manifested no change or progress, that might be all there was to it. But reason is continually being outgrown by life. The procession moves on. Demands arise that old adjustments, reason, cannot meet. An unknown quantity, an x, develops in the equation between the adequate idea and the nature of things. No manipulation of previous equations, or of cut-and-dried formulas, will alone suffice. The situation is unique. The value of x is new. That sense of the particularity of the situaiton—the "thisness" of the logicians—is the sensation or "impression." The appreciation of the sensation in the light of previous adjustments and habits, the interpretation of the break in this particular habit or set of habits, the conscious anticipation of stimuli appropriate to the reorganization of adjustments in order that the difficulty may be surmounted, are suggestions of what is the function of the imagination. The success of the function of the imagination in a particular case is the command for its own decline. The successful adjustment becomes through practice more and more a possession of reason. Control comes to be exercised with the minimum of conscious stimulus. Yet this adjustment, too, may later be brought into difficulties, though not exactly as before. So organically are reason and the imagination related in progressive experience that it would be truer to say that reason is the imagination generalized, and the imagi-

nation is reason particularized — which means that the analysis is not to be pushed to the extreme limit, lest the reality which it dissects come to life and escape the bounds of word-distinctions.

3. To what extent is the imagination a unifying, anticipating activity? (Hume.)

4. To what extent is the imagination co-operative with reason? (Hume.)

5. Why does the imagination fail to give a firm foundation to a rational system of philosophy — especially to the concepts of causation and substance, meaning by substance continued and independent existence? (Hume.)

These points are so closely related that they may be briefly discussed as one.

I have dwelt upon the value of Hume's theory of the imagination as a recombining, unifying, anticipatory activity, a theory which is both a criticism of Spinoza's theory of the imagination and a distinct contribution to modern psychology. I have attempted to point out, on the other hand, the hostility between the imagination and reason, which grows more open and acute with the development of the *Treatise*, and we have seen that Hume came to doubt the value of the imagination as a foundation of a rational system of philosophy. Both Spinoza and Hume doubted the compatibility of reason and the imagination. Their doubts can be shown to flow, I believe, from two psychological assumptions held in common: (1) the assumption that an analysis of the conditions of experience could be stated ultimately in terms of knowledge, instead of in terms of action; and (2) the assumption that the data of the imagination and of the perceptive faculties were so much material given from without.

Spinoza's ideal was, as we have already seen (p. 11), a character consisting of a knowledge of the unity existing between the mind and the whole of nature. If such a character or such a knowledge could be obtained, it would undoubtedly be reason, the unity, as controlled or habitual. The existence of the imagination, from this point of view, is plainly an evidence of failure to attain this character consisting of knowledge. If philosophy, as Spinoza seems to imply, be that perfect character consisting of a knowledge of the unity existing between the mind and the whole of nature, it can have no room finally for the category of the imagination.

Hume's ideal seems to have been the stating of the world in terms of the *ideas* of individual experience — again a knowledge ideal — and,

as we have seen, he found himself caught in a dualism between reason and the imagination. He discovered that reason tells us "that all our distinct perceptions are distinct existences, and that the mind never perceives any real connection among distinct existences" (p. 46, *supra*). Reason cuts the very substance of the world out from under the feet of individual experience. "Did our perceptions either inhere in something simple and individual, or did the mind perceive some real connection among them, there would be no difficulty in the case" (p. 46, *supra*). Hume also discovered that the imagination makes possible the ideas of causation and of substance, which reason denies. But he left the imagination where he discovered it, hanging in mid-air, like his man in the iron cage.

The point made in criticism of the assumption that an analysis of the conditions of experience can be stated ultimately in terms of knowledge, is that psychologically reason and the imagination represent mutually essential degrees of conscious control over action. Reason is the more effective, more complete, and therefore less conscious instrument of control. Imagination is the directing of a process of readjustment, and therefore is a more conscious instrument of control.

The second assumption (the numbering of the assumptions is, of course, a matter of no moment), namely, that the data of the imagination and of the perceptive faculties are so much material given from without, is involved in our last problem:

6. Does the imagination simply receive or operate upon ready-made data, conveyed to it through the sense-organs? To what extent is it merely receptive? To what extent is it creative? (Spinoza and Hume.)

To assume that sense data are literally data, or given from without, ready-made, is open to objection, if for no other reason, on the ground of the difficulties and contradictions which it involves. If sense data are distinct existences, as their plurality would imply, then we have on our hands Hume's problem of trying vainly to relate them. Imagination may succeed in tying them together, but reason says: "No, they come as many from without; and the without from which they come I know only as I know them — and I know nothing simple and individual in which they inhere." The psychological view that sensations, whatever else they are, and wherever else they may come from, are to be taken as we find them, and dealt with according to their function in locating critical points in experience, avoids a metaphysical problem which deserves dissolution rather than solution.

As to the latter part of the problem. Psychologically, every image, and, for that matter, every sensation, is creative. It is creative in that it is a stimulus; it modifies action or habits in some way. Every image recreates in some way the physical and psychical disposition of the individual organism that experiences it. As Professor James says in his chapter on "The Stream of Thought," *there "is no proof that the same bodily sensation is ever got by us twice. . . .* Every sensation corresponds to some cerebral action. For an identical sensation to recur it would have to occur the second time *in an unmodified brain.* But as this, strictly speaking, is a physiological impossibility, so is an unmodified feeling an impossibility; for to every brain modification, however small, must correspond a change of equal amount in the feeling which the brain subserves." (*Principles of Psychology*, Vol. I, pp. 231–3.) There are, of course, degrees in the modification undergone — degrees so wide apart as to amount practically to differences of kind — but it does not follow that the criterion of the creative character of an image is, as I understand Ribot to maintain (p. 53, *supra*), the novelty of the thing created. A thing which is to all outward appearances perfectly commonplace may be the result of a tremendous reconstruction of individual habits; and a thing which to outward appearance is strikingly novel may be the result of comparatively little readjustment of individual habits.

Throughout this entire discussion there has been a constant endeavor, perhaps not always apparent, to search for and to appreciate, however inadequately, the positive value and significance to psychology of these theories regarding the imagination.

The strength of Spinoza's theory of the imagination lies in its rejection of the fallacious scholastic doctrine which explains the formation of abstract ideas or concepts as a process of agglutinating images. It is certainly true that ideas so formed would lack universality as much as the sense-materials out of which they were made. There could be no agreement between any two individuals as to the respective contents of their minds. But in rejecting such a doctrine Spinoza also rejected individuality as such, in favor of that spiritual automaton which is the knowledge of its union with the whole of nature. The only doctrine regarding sensation and imagination that he could command was one that compelled him to reject both categories from philosophy, and retain but the bare forms of thought, which reduce to identity.

The strength of Hume's theory, on the other hand, lies in its

recognition of the imagination, not as mere revival, but as the individual's carrying forward, projecting, of the data of his experience. With Hume, however, as well as with Spinoza, the individual was an abstraction. Spinoza left him the passive prey to outward circumstances; and pointed out that his salvation lay in becoming the zero of one member of a mathematical equation, the other member being *Deus sive Natura*. Hume equipped him for progressive action, provided him with certain important instruments with which to control a world of objects; and then failed to find him a field of action, a world in which to live.

By a curious paradox, he who set out with intellectual unity — the unity of science — as his ideal, became the greatest separatist in the history of philosophy — his dualism cutting far deeper than Descartes's and into the very heart of character, of individuality. Whereas he who has been commonly regarded as the arch-skeptic undertook to found his most important philosophic categories on the forward movement of the imagination, which faculty is the basis, I think we may say, of the spirit of all prophecy.